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Product: **Graphos (Graphical Variable Message Sign / Vehicle Activated Sign)**

Title: **GVMS PRODUCT HANDBOOK**

Prepared : S. White

Function : Engineer

Issue	Change Ref.	Date
1	First Issue	12th December 2005
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4	TS004029	4th September 2007

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CONTENTS

SAFETY WARNING

HEALTH AND SAFETY AT WORK

Safety of Maintenance Personnel

In the interests of health and safety, when using or servicing this equipment the following instructions must be noted and adhered to:

(i) Only skilled or instructed personnel with relevant technical knowledge and experience, who are also familiar with the safety procedures required when dealing with modern electrical/electronic equipment are to be allowed to use and/or work on the equipment. All work shall be performed in accordance with the Electricity at Work Regulations 1989.

(ii) Such personnel must take heed of all relevant notes, cautions and warnings in this Handbook and any other Document or Handbook associated with the equipment including, but not restricted to, the following:

(a) The equipment must be correctly connected to the specified incoming power supply.

(b) The equipment must be disconnected/isolated from the incoming power supply before removing any protective covers or working on any part from which the protective covers have been removed.

(c) This equipment contains a Lithium battery that must be disposed of in a safe manner. If in doubt as to the correct procedure refer to the Siemens instructions CP No. 526.

(d) Any power tools must be regularly inspected and tested.

(e) Any ladders used must be inspected before use to ensure they are sound and not damaged.

(f) When using a ladder, before climbing it, ensure that it is erected properly and is not liable to collapse or move. If using a ladder near a carriageway ensure that the area is properly coned and signed.

(g) Any personnel working on site must wear the appropriate protective clothing, e.g. reflective vests, etc.

In the event of more than one person working on the equipment, the Mains Supply to the Driver Module must be disconnected by removing the fuse.

More specific safety information is given within the text of the handbook, where it relates to particular activities or situations.

Safety of Road Users

It is important that all personnel are aware of the dangers to road users that could arise during repair and maintenance.

Signing and Guarding shall be to Highways Agency TSM.

Terms and Definitions

ALS	Ambient Light Sensor.
Azimuth	The horizontal angle by which an AGD is moved in order to perform its function correctly. Zero degrees is considered parallel to the flow of traffic and a positive azimuth defined as clockwise movement of the AGD when viewed from above.
Bluetooth®	An international specification for short range wireless communication between electronic devices.
Carrier Freq.	The transmitted frequency of the radar used to generate a Doppler shift from moving targets.
Cluster	A Master Graphos sign and up to three Slave Graphos signs.
CPU	Central Processing Unit.
Declination	The vertical angle below the horizon that the AGD is angled in order to perform its function correctly. 0° is horizontal and a positive declination angle is towards the ground.
Gap	The distance (or time elapsed) between the front of one vehicle and the rear of the preceding vehicle in the same lane.
GSM	Global Mobile telephone System.
GVMS	Graphical Variable Message Sign.
Hold time	The period in seconds during which the AGD's output remains active after a speeding vehicle has been detected.
ILD	Inductive Loop Detector. A type of detector which uses the magnetic field set up by buried turns of wire in the carriageway to detect vehicles.
Illuminance	The amount of light falling on a object or area. Measured in Lux. In the context of this handbook - the ambient level of light falling on the sign.
K-Band	The band of electromagnetic radiation from 18.0 GHz to 26.5 GHz.
LSCU	Lamp Switch Control Unit (Graphos Control Board).
LST	Low Speed Threshold. The speed of the target on axis below which the target will not be detected by a Doppler radar.
Luminance	The amount of light emitted from a surface or area. Measured in cdm^{-2} In the context of this handbook - the level of light emitted from the sign.
Masking	Signal from a more dominating target obscuring a signal from a target or zone of interest.
Master	A Graphos sign containing a Gemini CPU.
MDU	Mains Distribution Unit.
Platoon	Two or more vehicles travelling in the same lane at the same speed in close proximity.
PSTN	Public Switched Telephone Network.
Radar	A device which uses electromagnetic radiation at a nominal frequency from 1 GHz to 100 GHz to detect a target.
Range	The distance from a radar to the target at the onset of detection.
RMS	Remote Monitoring System.
SiTOS	Siemens Traffic Outdoor Station.
Slave	A Graphos sign without a Gemini CPU but with a SiTOS connection to a Master.
SmartLink	Siemens proprietary short range communications system for traffic equipment.
STC	Siemens Traffic Controls.
UTC	Urban Traffic Control.
VAS	Vehicle Activate Sign
VMS	Variable Message Sign. A traffic sign capable of displaying more than one instruction at different times.
VSL	Variable Speed Limit.
X-Band	The band of electromagnetic radiation from 8.2 GHz to 12.4 GHz.

Owing to Siemens Traffic Controls' policy of continuous improvement product specifications may be updated from time to time. The following information given in this handbook is for guidance only. Any item of particular interest to the user should be checked Siemens Traffic Controls to ensure validity.

1 PRODUCT OVERVIEW

This handbook describes the operation and installation of the Graphos range of variable message signs. The signs are characterised into three types:

- **Speed warning signs.** These signs are activated by speed measuring detectors. The detectors can be loop or microwave based. The signs are blank for a great proportion of the time but illuminate when vehicles are detected travelling in excess of the speed limit and display the speed limit to remind drivers of the speed limit in force.

- **General purpose warning signs.** These are used to warn motorists of potential hazards such as sharp bends ahead. They are similar in function to Speed Warning signs but are usually larger and use symbols mostly within the red warning triangle. They usually are activated by vehicles travelling over a speed threshold but other activation methods are possible. Alternative activation methods are axel measurement via loops for weight restrictions or high detection for low bridges, etc.

- **Variable speed limit signs.** These signs are used to set the speed limits and allow them to be changed, usually at certain times of the day. Typical applications are for use around school entrances, to reduce the speed limit, for example to 20 mph, at times of the day when school entrances are active. These signs usually do not have any form of detection present as the variable speed limit is activated by a time table held within or communicated to the sign.

The type of sign very much depends on the application it is being used for. All Graphos signs use common elements to construct each of the three sign types.

2 PRODUCT SPECIFICATION

Designed to comply with TR2516 A November 2005.

Lightweight enclosures. Five sizes of enclosure, incorporating vertical tilt and horizontal rotation adjustment to allow the signs to be adjusted for optimum driver visibility.

The smaller signs include a sacrificial device - as used on the Siemens Helios traffic signal. This device breaks and absorbs energy during an impact and prevents expensive damage to the message sign.

A wide range of graphical symbols are available. Speed sign 300 mm, 450 mm and 600 mm standard roundels are available. Warning triangle 600 mm, 750 mm and 900 mm sizes are available with any of the suitable symbols as noted in TR2516 A, under section title “Message Legend and Fromat” referring to TSRGD.

The Graphos sign offers the ability to display fixed text on the sign aspect, for example ‘SLOW DOWN’ in association with symbols when TSRGD regulations permit this.

All signs may be supplemented by flashing amber lanterns to further attract driver’s attention.

The range of signs offer flexibility in the symbols and text that can be displayed. Where an HA approved symbol is not available. signs with custom symbols may be produced within a very short space of time, any such symbols are subject to H.A. approval (where applicable) and any technical restrictions (e.g. space to fit symbol).

Each sign is fitted with an ambient light sensor to determine ambient illuminance. The luminance of the sign is automatically adjusted to best suit prevailing lighting conditions. The sign adjustment is through five different luminance levels.

The signs can be triggered by an “above ground” speed threshold detector. A Siemens vehicle classifier using underground speed detection loops or by any external input.

Graphos can incorporate a Siemens Gemini outstation and with this option offers full compatibility with a Siemens RMS in-station. This permits remote fault monitoring and configuration from a centrally located in-station.

2.1 ELECTRICAL SPECIFICATION

Power consumption naturally varies dependent upon the size of the sign below is what is a typical sign with TWO LDBs:

Supply 230 Volts +10% - 15%

Full brightness activated	40 watts
Quiescent not activated	17 watts

Power consumption for a Large Worst case sign would be:

Full brightness activated	94 watts

2.2 POLE SPECIFICATIONS

Poles are designed around the required strength for the sign area and weight, we have available a selection of poles and foundation designed around these signs. Firstly there is a small belled (simple power distribution only), then there is a large belled (more complex power distribution allowing space for loop detectors and termination of master to slave linking cables) so generally always used where a Gemini is fitted. See Sections 4.14 & 4.15

2.3 SITE SELECTION AND INSTALLATION GUIDELINES.

1. There should be no other signage i.e. metallic direction signs, regulatory signs, hazard warning signs, etc., between the Graphos sign and point of detection as:
    a. This situation could potentially limit and/or obscure the visibility of the sign to approaching motorists.

2. There should be no Bus Stops or shelters between the Graphos sign and point of detection as:
    a. This situation could potentially limit and/or obscure the visibility of the sign to approaching motorists.
    b. This situation could obscure vehicles from being detected by the AGD. (Does not affect loop detection).
    c. This situation could potentially delay the detection and activation of the sign, with or without a bus present, when using an AGD. (Does not affect loop detection).

3. There should be no lay-by between the Graphos sign and point of detection as:
    a. This situation could potentially limit and/or obscure the visibility of the sign to approaching motorists.
    b. This situation could obscure vehicles from being detected by the AGD. (Does not affect loop detection).
    c. This situation could potentially delay the detection and activation of the sign when using an AGD, due to high sided HGV's, etc. parked within the lay-by confines. (Does not affect loop detection).

4. Avoid installing on bends if:
    a. The situation could potentially limit and/or obscure the visibility of the sign to approaching motorists.
    b. The situation could potentially delay the detection and activation of the sign when using an AGD. (Does not affect loop detection).

5. Be aware, if the installation is to be done in rural wooded areas or any such area where there are trees, shrubs, foliage, etc., the sign is to be located such that the visibility of the sign to motorists between the point of detection and the sign itself is not limited and/or affected by any of these.

Note: Please remember that overgrowth will occur over a period of time and should therefore be given serious consideration, with the above, when selecting the location of the sign.

6. If there is no option but to locate the sign close to trees, shrubs, foliage, etc., then check with the local authority to see if there are any environmental issues, sensitivities, protective legislation, etc. governing that particular area, as it may be necessary during preventative maintenance, to cut back any overgrown trees, shrubs, foliage, etc. that have, over a period of time, encroached into the area between the point of detection and the sign itself, affecting and/or limiting the visibility of the sign to motorists. If there are any issues then ensure that these are documented along with the procedure to be followed in the event that this remedial work is required.

3 SYSTEM BLOCK DIAGRAM

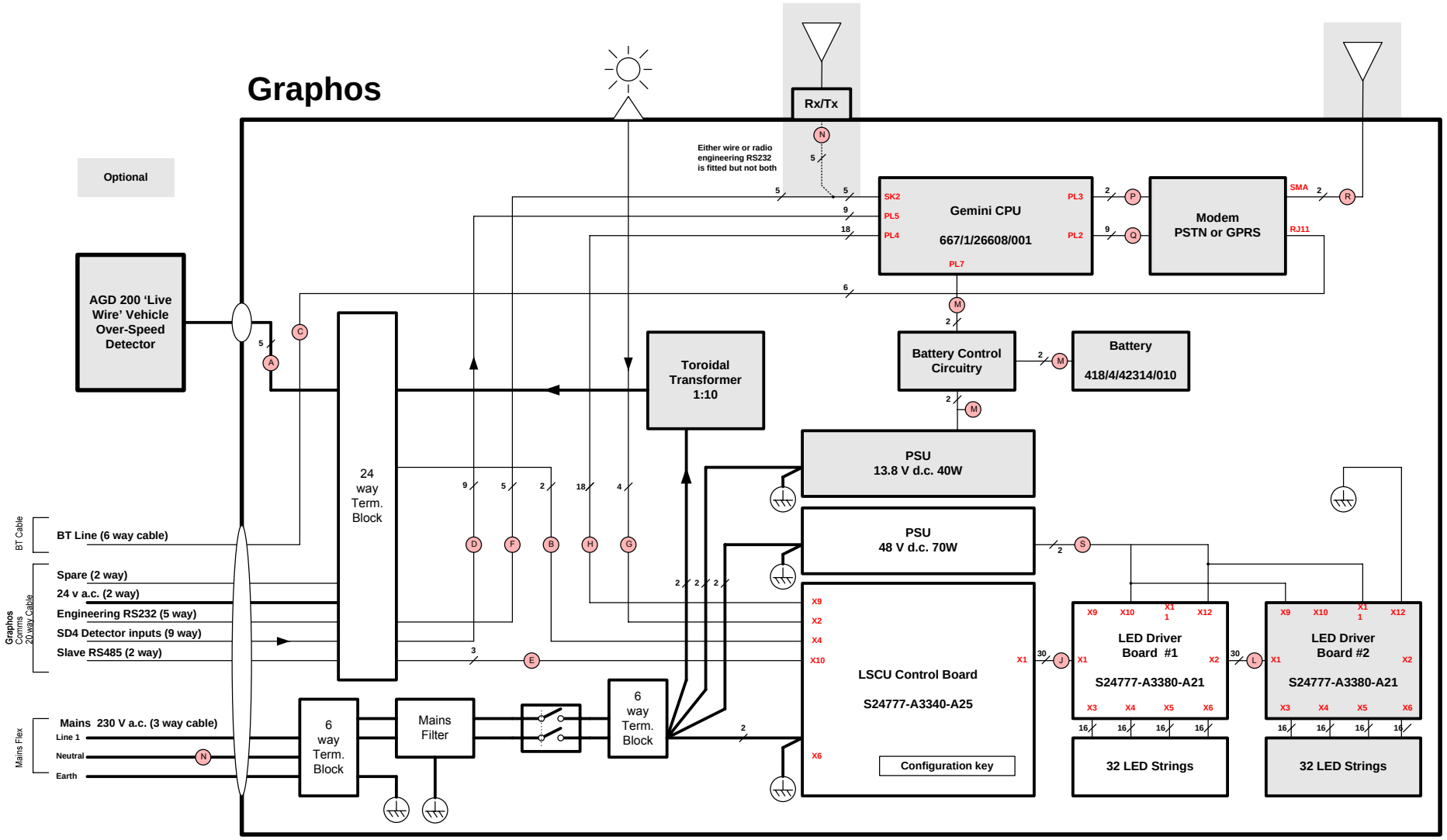


Figure 1 Graphos block diagram

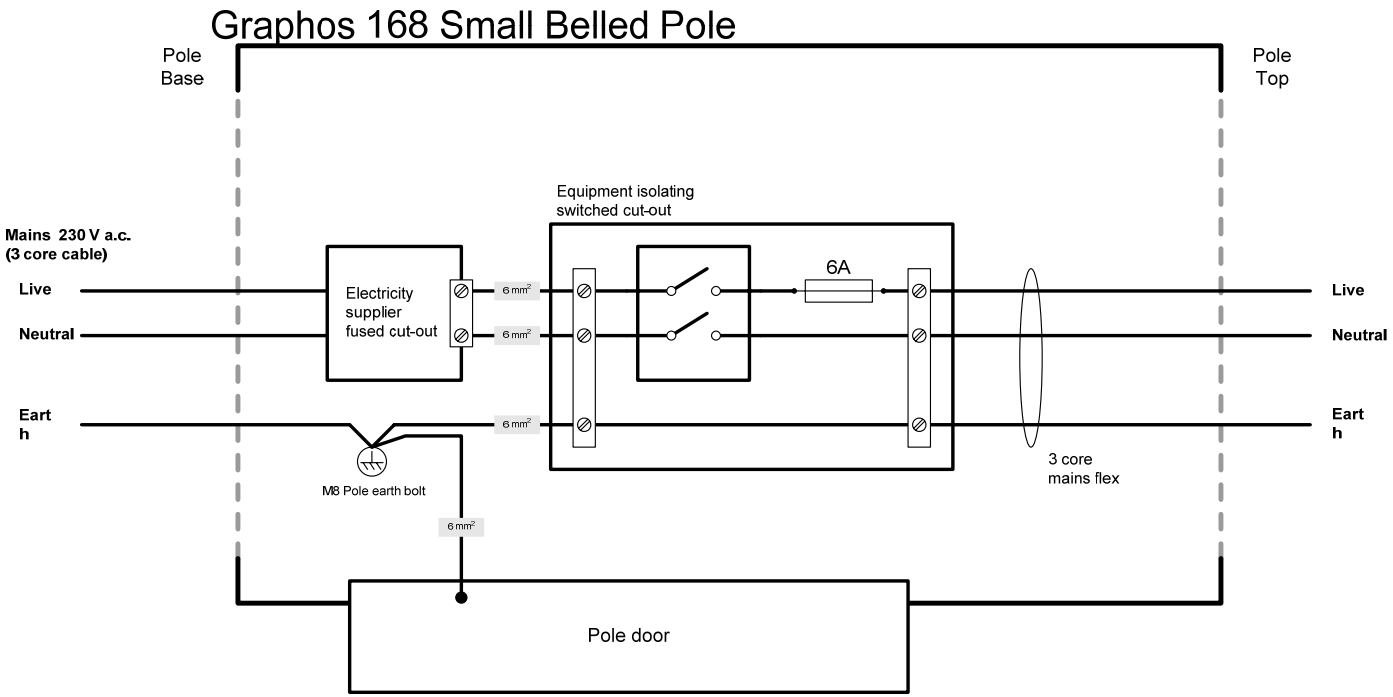


Figure 2 Graphos 168 Small belled pole block diagram

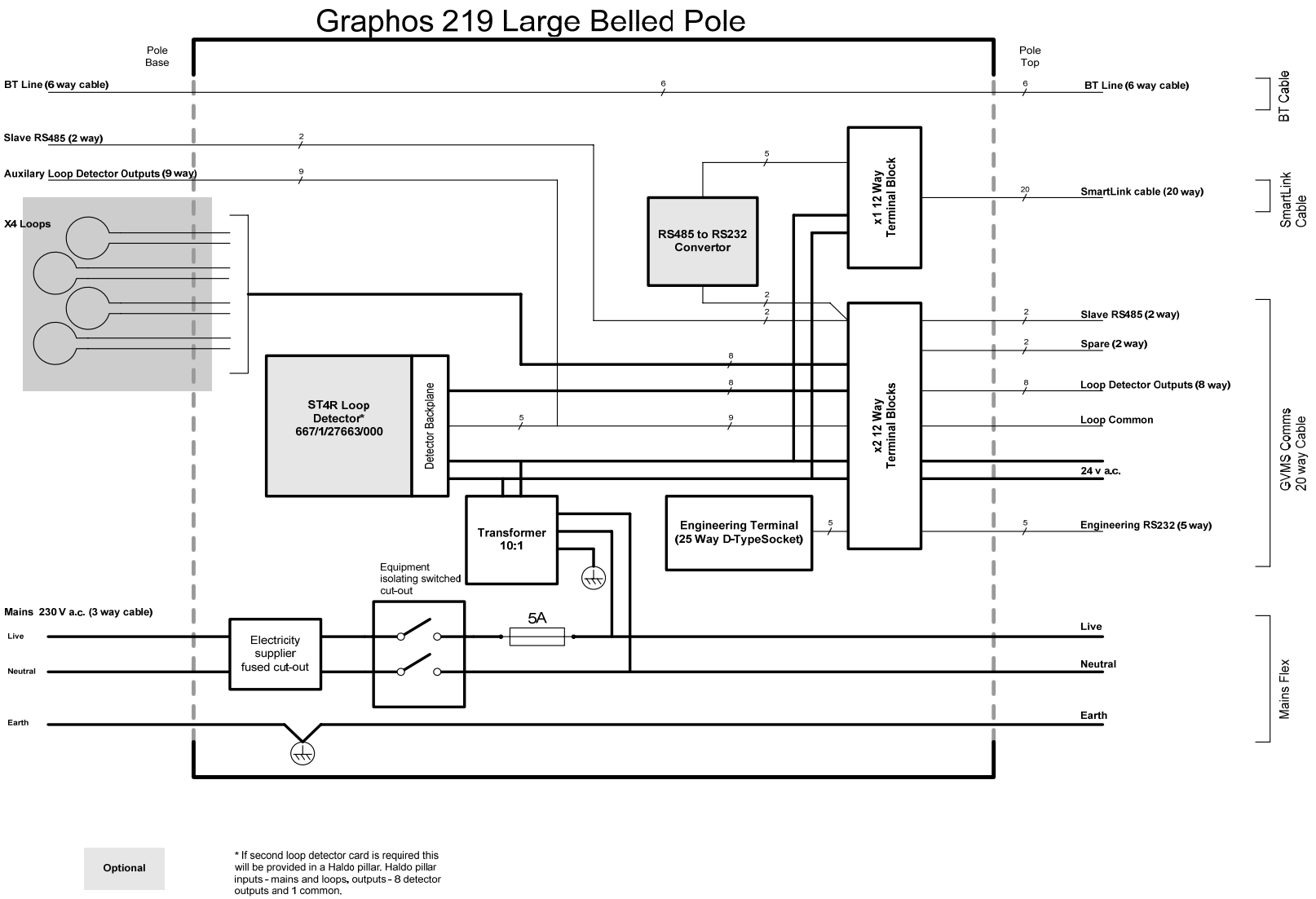


Figure 3 Graphos 219 Large belled pole block diagram

4 SYSTEM ELEMENTS

4.1 GENERAL DESCRIPTION

Each Graphos comprises a sign body, mounting pole and bracket arrangement. All signs in the Graphos range use a common electronics panel. This panel has all the key elements of the sign, with the exception of LED strings, antennae, ALS (Ambient Light Sensor) and AGD, mounted to it. For ease of service and repair the panel can be easily removed from the sign as can all the main elements attached to it.

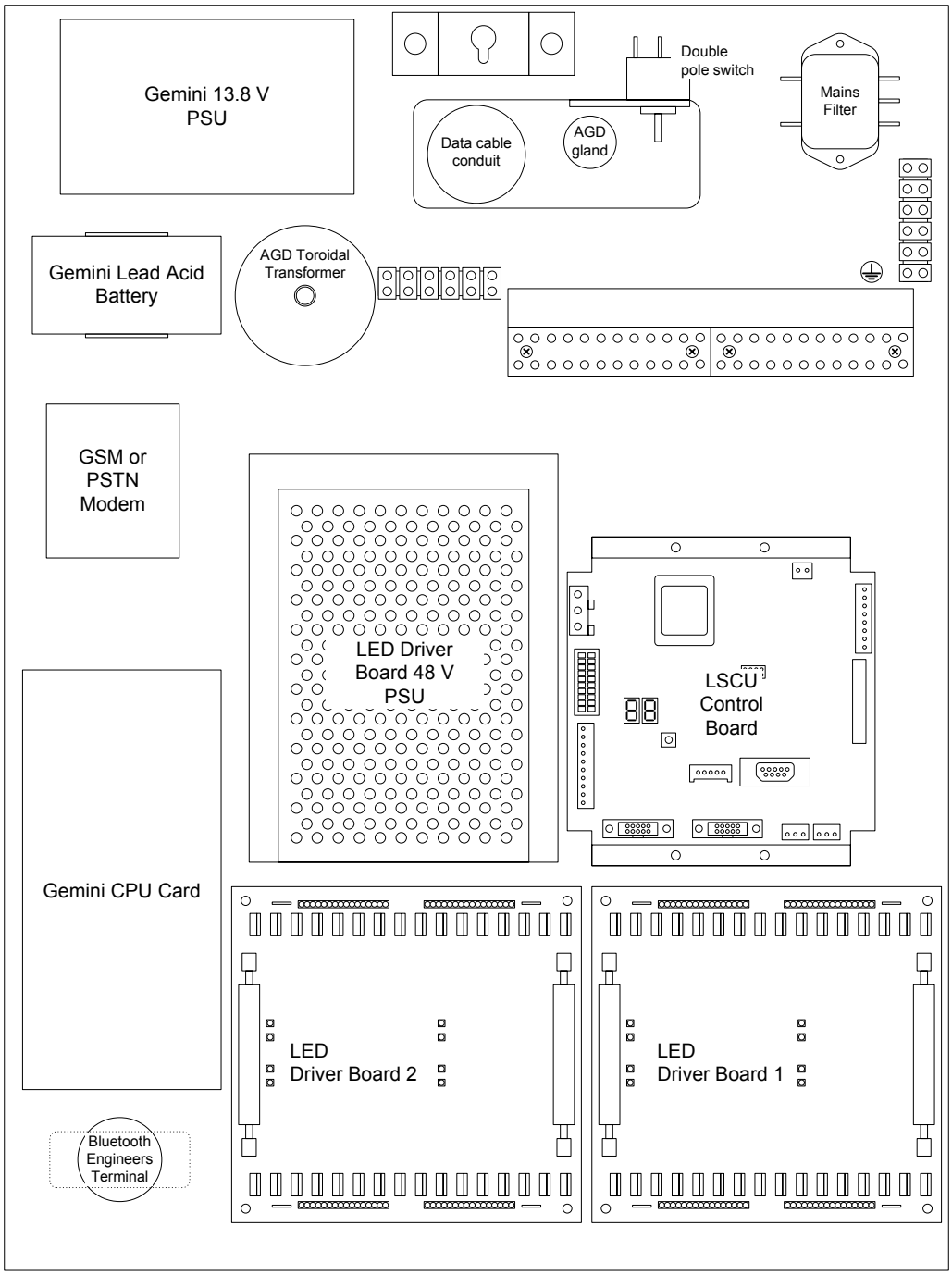


Figure 4 Graphos electronics panel general assembly

4.2 EXTERNAL CABLING

There are four external cables that enter the Graphos enclosure. Three of these do so through a 25 mm diameter plastic conduit. These cables are; PSTN flex, twenty way data cable and mains flex. All these three pass through the conduit to the sign mounting pole. The fourth cable is the AGD cable. This leaves the enclosure through a gland and travels the short distance to the AGD mounted above the sign.

PSTN flex

This is a conventional six way phone cable that connects the PSTN modem (if fitted) and a BT master socket mounted at ground level in a Haldo pillar (or similar) near by. This cable has an RJ11 plug at the modem end and a BT plug at the master socket end.

Twenty way data cable

This cable takes all the data signalling from the sign to a set of terminal blocks at the base of the pole. This cable is only installed with a 219 pole. The 219 pole has a large belled base that houses a detector transformer, detector card, MDU and three twelve way terminal blocks. The 168 pole is for simpler installations where the extra features are not required. The cable comprises of 10 twisted pair cores. Each wire is solid core tinned copper. Each wire is uniquely coloured with a body and stripe colour.

Mains flex

This is a three way mains flex that terminates the MDU mains isolator (in the pole belled base) with the six way mains terminal block in the sign enclosure.

4.3 MAINS FILTER

This is a metal enclosed device with spade terminals. It removes any spurious interference from the mains supply that may effect the sign and prevents any emissions from the sign being conducted down the mains cable and out of the sign.

4.4 DOUBLE POLE SWITCH

This provides total mains isolation when working within the sign. It prevents the need for the service engineer to return to ground level to isolate power at the MDU. This can save significant time when working at height. Typically this will be used when replacing a PSU, LSCU control board, LED driver board, etc.

4.5 LSCU CONTROL BOARD

The LSCU control board runs the software that performs all the fundamental sign operations. This card is powered directly by mains voltages so care should be exercised when working with this card powered. Power must be isolated if it is necessary to replace this card.

The software in the LSCU control board is held in electrically erasable flash memory. Within the sign the card communicates serially with any number of LED driver boards using a 30 way ribbon cable. The LED driver boards are connected in a “daisy chain” fashion using this 30 way serial bus with each driver board having a one in one out connection. The driver board has a reset button to re-initialise it and a two digit seven segment display to assist service engineers analyse sign faults. The board also has a socket to retain a configuration plug.

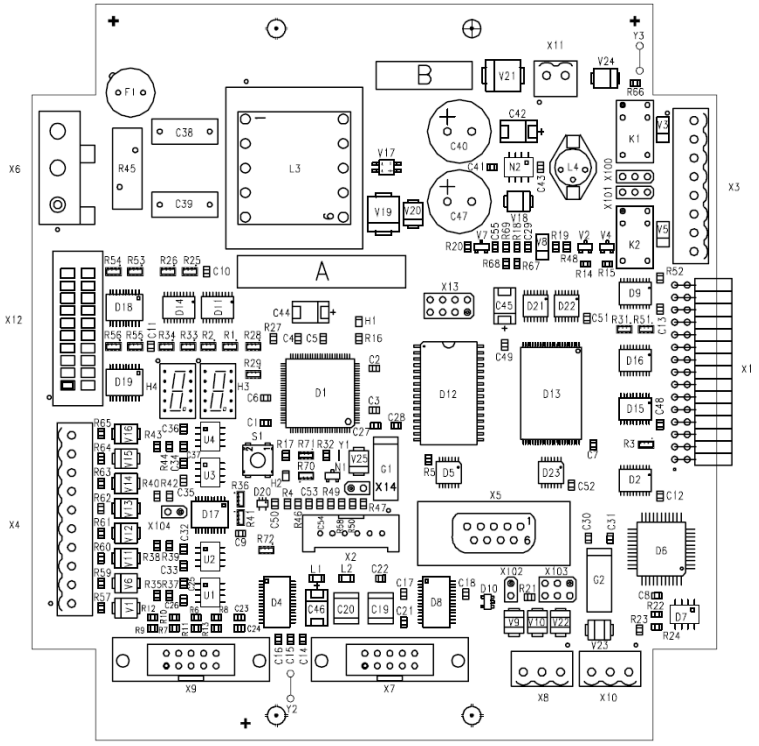


Figure 5 LSCU control board component layout

When a Graphos sign is enhanced with a Gemini CPU it communicates with its LSCU control board with RS232 signalling between X9 (LSCU control board) and PL4 (Gemini CPU). Communications externally between signs are always made through the LSCU control board using its SiTOS RS485 interface.

4.6 SITOS CONNECTIONS

Master and Slave LSCU control boards use different connectors for their SiTOS connections. The Master always uses X10 and the Slaves always use X8. By default all Graphos signs are wired with the terminal blocks connected to the Slave connector X8. When configuring a Master the plug in X8 should be removed and inserted into X10.

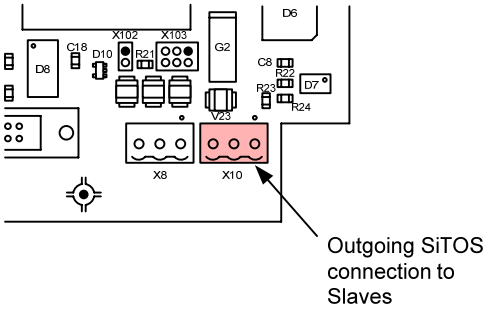


Figure 6 Master LSCU control board SiTOS connection

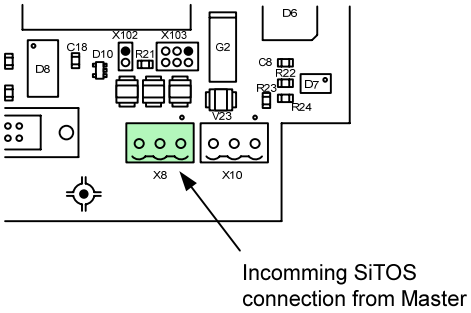


Figure 7 Slave LSCU control board SiTOS connection

Connections between Master and Slave signs is a simple one to one daisy chain of Data_A to Data_A and Data_B to Data_B.

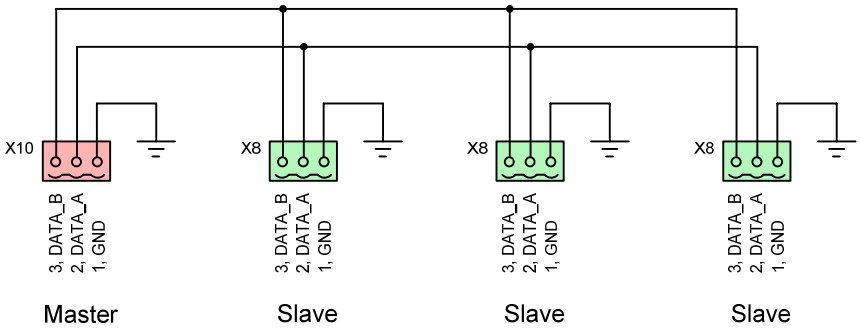


Figure 8 SiTOS daisy chain connection of Master and Slaves

4.7 GRAPHOS CONFIGURATION PLUG

This configuration plug is a small fibre-glass circuit board that sits in a socket on the control board. Without it fitted the sign will not operate correctly. The configuration plug stores basic field changeable settings for the sign. Each configuration plug starts life un-configured. It has sixteen bits (links) that are set (cut or left connected) to make the sign operate as the customer requires. This information is set by the factory when the sign is manufactured. A paper copy of the customer settings is provided in each sign enclosure.

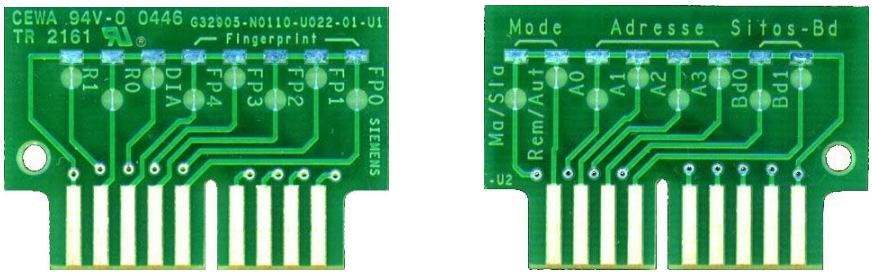


Figure 9 Configuration plug, front and back view

4.8 LED DRIVER BOARD

This card drives the strings of LEDs in the sign. Each card is capable of driving 32 separate strings of LEDs. Each sign will have one or four of these cards depending on the application and the number of LEDs in the sign. Each driver board has status LEDs to assist with fault finding.

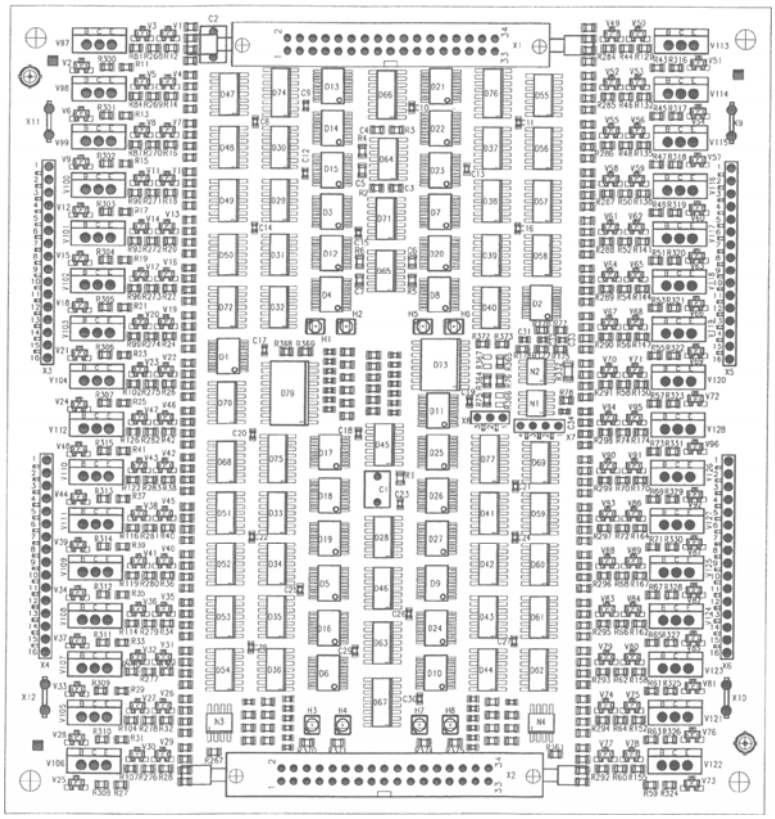


Figure 10 LED Driver Board component layout

4.9 POWER SUPPLY UNIT (48 V)

The Graphos product has a separate power supply to power the LED driver boards. This PSU develops 48 V d.c. It is a convection cooled model that is rated to 110 W at 50 °C and 55 W at 70 °C. In this application it is recommended that it is 50% derated. Where more than 55 W are required in a single Graphos sign multiple PSUs can be used with one PSU powering each driver board separately.

There are two alternative sources of 48 V PSU than can be used with Graphos. These are the Power-One MAP140-1048 and the Lamda HWS150-48/A. Each PSU has slightly different wiring schemes. The figures below show the wiring connections for each of the two PSU types. Note that each PSU has a voltage adjustment. This shouldn't be altered in any way. Note also that each PSU has a fuse, this is for internal protection and shouldn't under any circumstances be replaced if at fault. If a PSU is faulty it should be replaced.

Note also that the Power-One MAP140-1028 PSU has Molex plug connectors whilst the Lamda HWS150-48/A has screw terminals. If replacing a Lamda power supply with a Power-One PSU the cabling also has to be replaced.

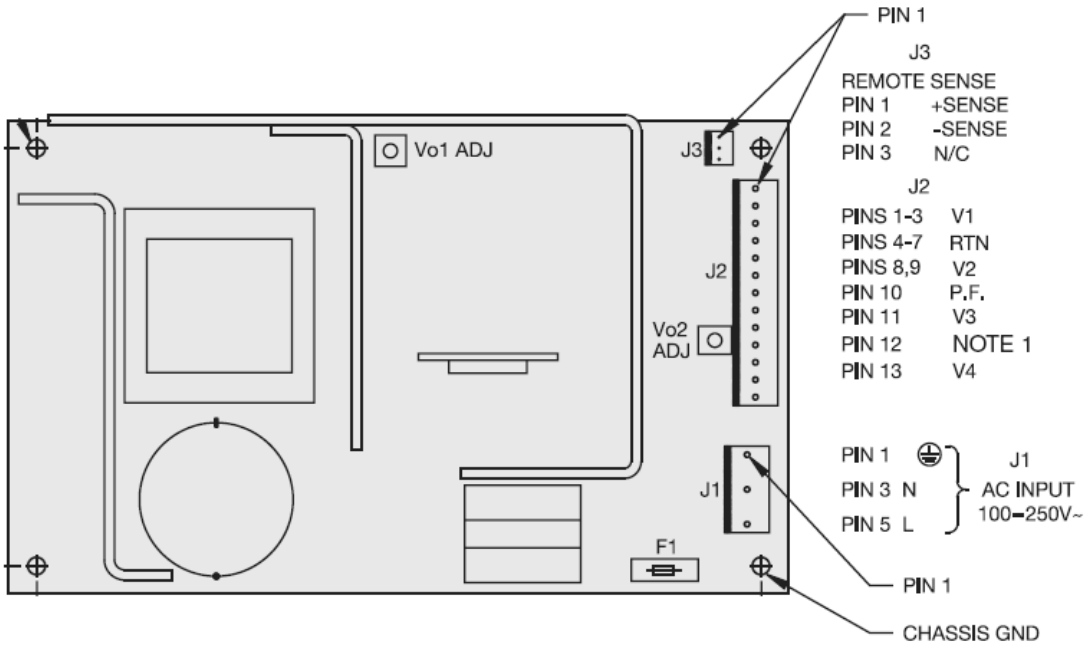


Figure 11 Power-One MAP140-1048 connections

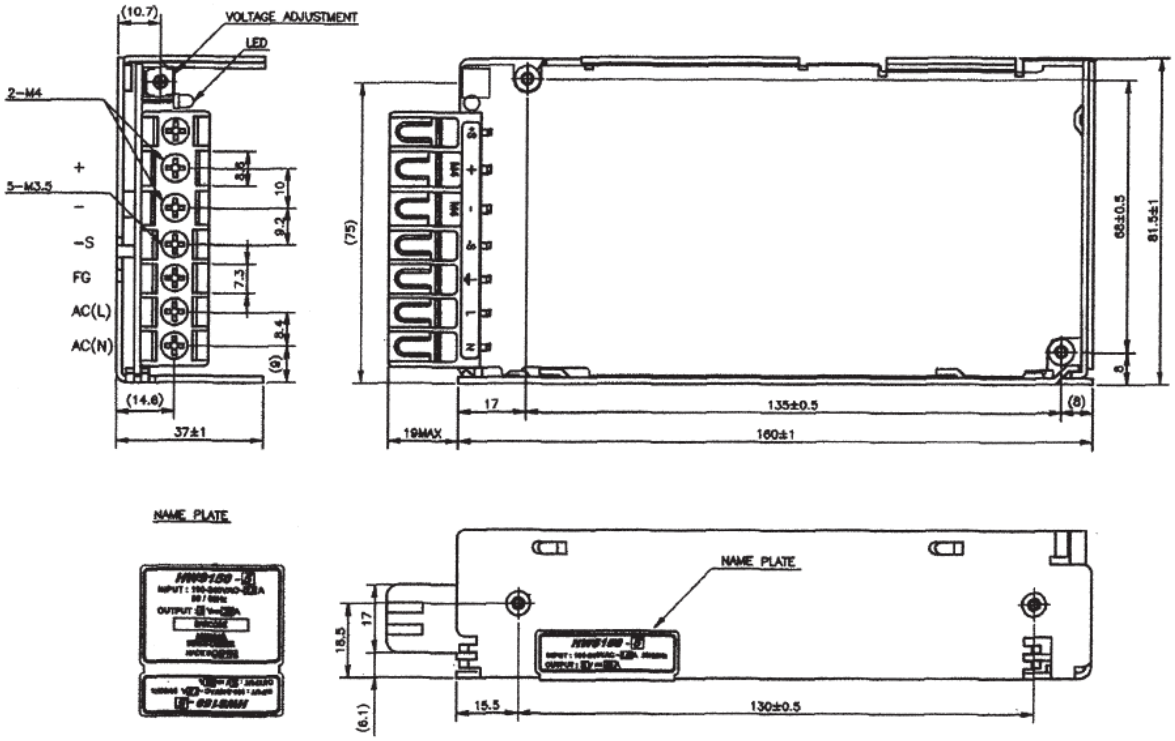


Figure 12 Lamda HWS150-48/A connections

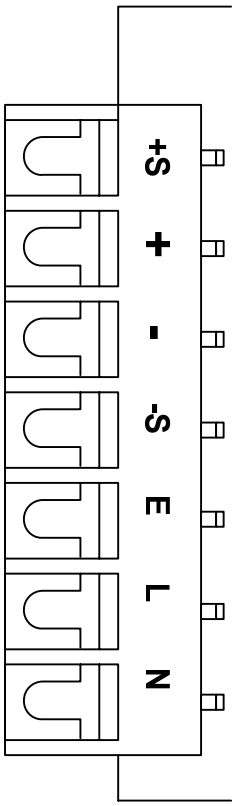


Figure 13 Lamda HWS150-48/A terminal block detail

The 48 V PSU is provided with a cover to protect the service engineer from contact with hazardous voltages. Power to the sign must be isolated before this cover is removed.

4.10 ALS

The ALS (Ambient Light Sensor) measures the light level and enables the sign to adjust its luminance level for best visibility in the prevailing light conditions. The ALS plugs into the LSCU control board using a polarised five pin connector. There are no serviceable items within the ALS. If it fails it is simply replaced. The ALS is attached to the sign by a plastic M20 nut. A sealing washer on the body of the sign seals it to prevent water ingress. The M20 nut is to be firmly hand tightened when attaching the ALS. Over tightening the ALS will damage it and could cause the sign to admit water when it rains.

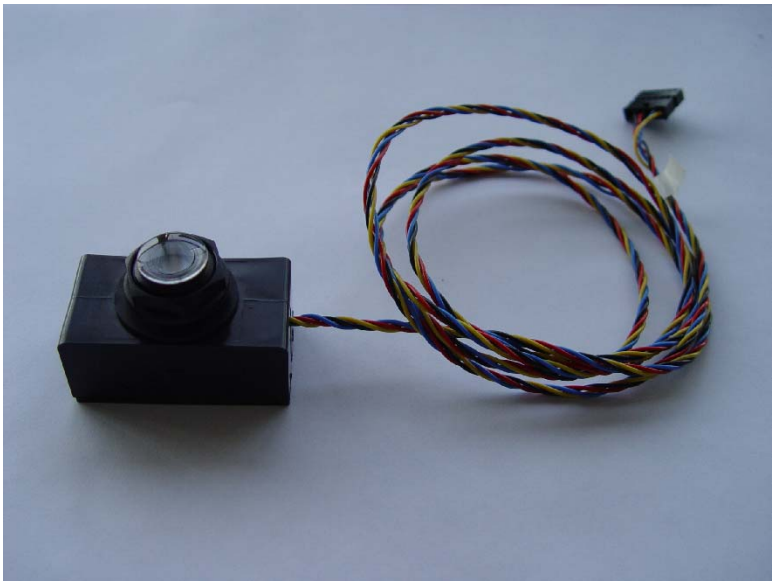


Figure 14 ALS assembly

The ALS is positioned at the top of the sign and measures the light falling on the sign from above rather than the light on the surface of the sign. The sign is automatically adjusted to one of five different luminance levels in response to the signal received from the ALS. ALS operation can be checked by covering it temporarily, the sign will adjust its luminance accordingly within a period of 30 seconds.

4.11 LED STRINGS

The LEDs used in the Graphos product are of the 5 mm type. There are three colours used as standard on the Graphos product; Red, Yellow and White. They are arranged in strings serially connected. It isn't possible to identify the colour of an LED just by looking at it so the wires used to connect the strings are colour coded. There are 19 LEDs in the Red and Yellow strings and 11 LEDs in the White strings. The reason for the different numbers of LEDs is that White LEDs need a higher voltage to drive them so correspondingly less can be driven by a 48 V PSU. As the LEDs are serially connected if one becomes open circuit the whole string will extinguish. Each sign is provided with a test mode accessed by the configuration plug. In test mode the sign will cycle through all available pictures on that sign allowing faulty strings to be quickly identified.

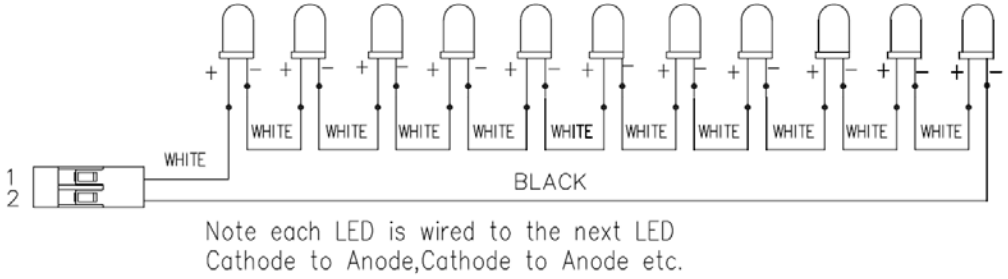


Figure 15 Typical Graphos LED string

4.12 LED LENSED HOLDERS

The LED strings are held in place with lensed holders. These lensed holders direct and concentrate the light from the LEDs. The holders have sprung plastic lugs that hold them in the front panel. To remove and replace them squeeze the sides of the holder on the inside of the display panel and then ease the holder out the front of the sign. When replacing the holders note that they have a key on the side and can only be inserted in the correct orientation. When inserting a holder make sure the retaining lugs spring out or the sign may not be sealed sufficiently to prevent rain water from entering. Insert the LED holder before attaching the LED into the back of the holder.

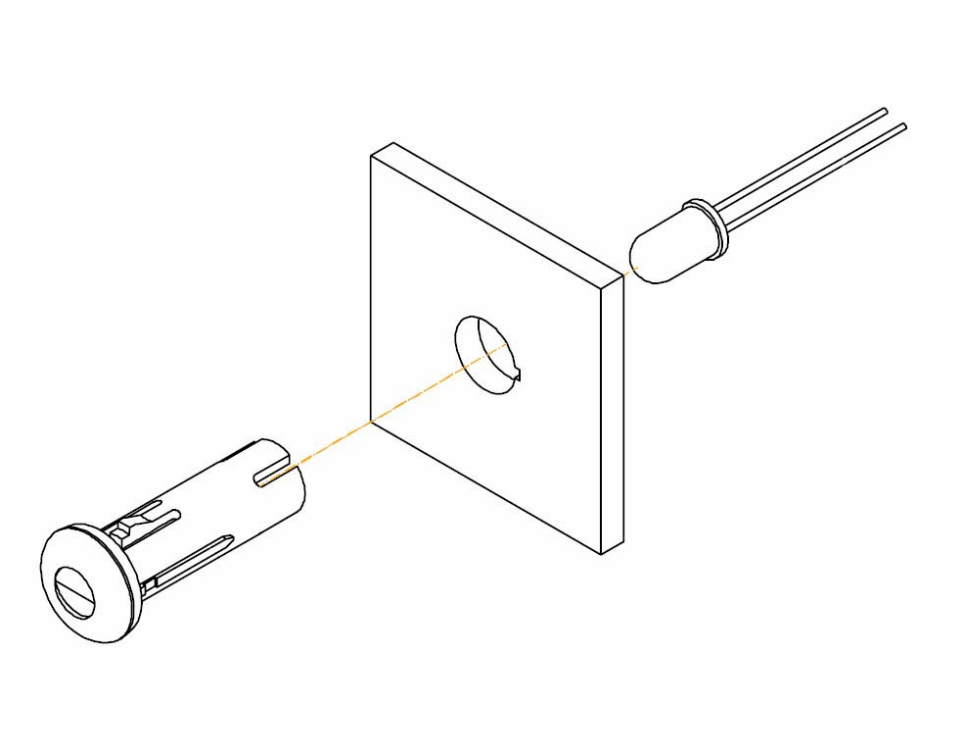


Figure 16 Graphos LED holder - front view

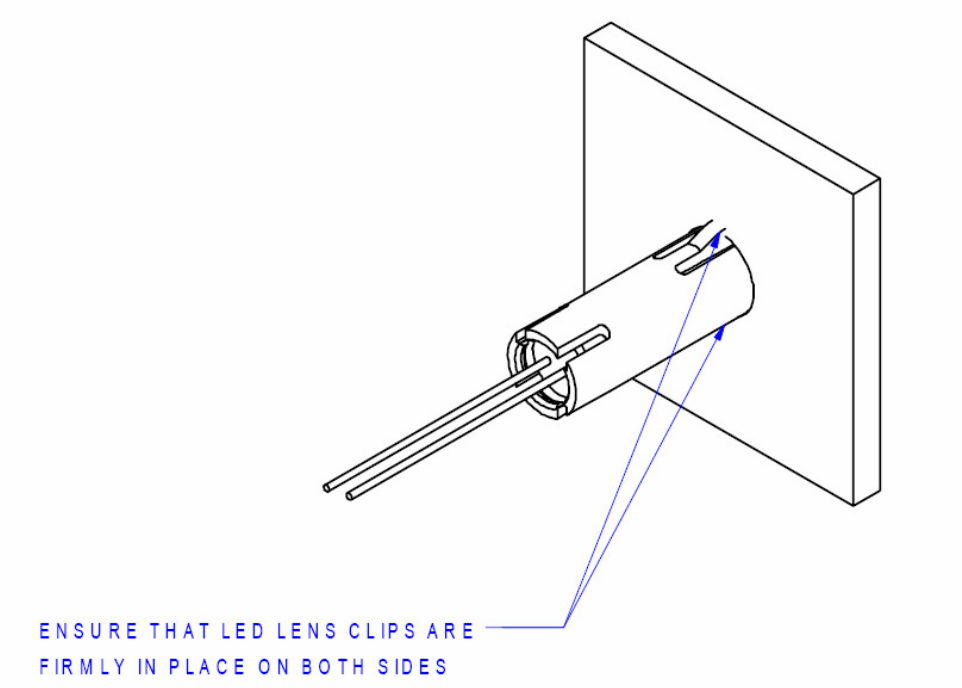


Figure 17 Graphos LED holder - rear view

4.13 TERMINAL BLOCKS

All connections to the outside world from the Graphos product are through two terminal blocks.

The mains flex enters the sign through the six way terminal block on far right of the electronics panel under the filter. This terminal block is easily identified as it has two transient suppressors (the red discs in figure 8) connected between neutral, live and earth. To ease wiring and give separation between the mains cores, alternate ways of the terminal block are used. With the exception of the earth (the bottom terminal next to the earth symbol stamped into the aluminium), there is no labelling on the terminal block to indicate connections. Wire colours should be matched either side of the terminal block, i.e. Live, Brown to Brown, Neutral, Blue to Blue. All installation wiring will be to the terminals to the left of the terminal block.

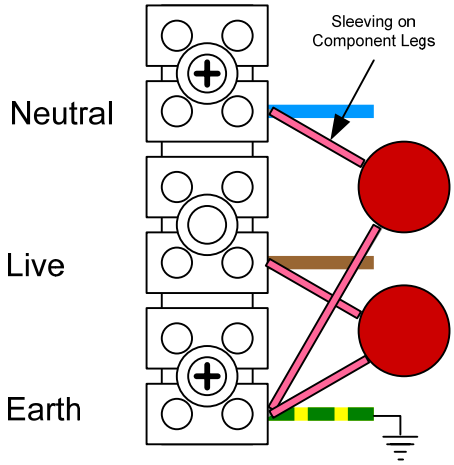


Figure 18 Mains terminal block wiring

The second terminal block is for all the main data communications to and from the sign. This is a large 24 way block that extends across the width of the sign below the six way mains terminal block.

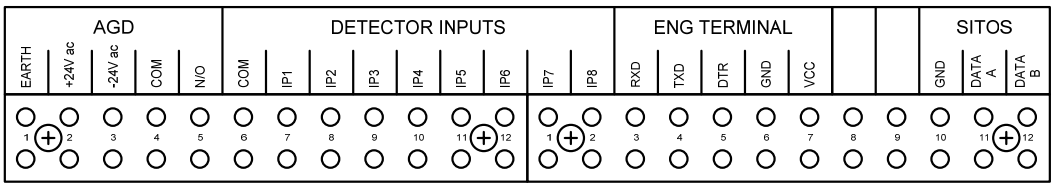


Figure 19 Graphos data terminal block

Working from the left the connections to the sign are grouped by function. These are Detector Inputs, Engineering Terminal, AGD and SiTOS.

Detector Inputs

Detector inputs are inputs to the sign from loop detectors. One four channel loop detector card can be housed within the 219 pole and a further detector can be housed in a nearby Haldo pillar. This gives the Graphos sign the capability of monitoring up to eight loops. All these connections are wired directly into a Gemini CPU card. This is an optional feature and isn't provided on the simpler signs. The signals inputs are relay outputs from the detector card they all use a single common that is linked at the detector backplane.

Engineering Terminal

When a 219 pole is used there is the capability of accessing the engineering terminal port of the Gemini CPU via a socket provided in the base of the pole. This enables the Gemini CPU

card to be interrogated at ground level using handset functions without the need to open the sign enclosure.

Spare
There are two spare connections. These are not labelled and are for future use.

AGD 200 'LiveWire'
Five connections are provided for the AGD (Above Ground Detector). The AGD is mounted externally to the sign and connected with a ten core cable through a cable gland into the sign enclosure. This cable has a ferrite attached to it to minimise EMC emissions. This ferrite has to be attached during installation and should be positioned as close to the cable gland as possible.

Although the AGD has a ten core cable only five of these cores are required. The five unused connections are to be tied back and insulated. Refer to table 1 A01 to A05 to identify the colours of the wires and their function.

SiTOS
SiTOS is the name of the communications protocol that the sign uses to communicate with up to three slave signs. The interface used is RS485. The master sign in a cluster of four linked Graphos signs will always have a Gemini fitted whilst the slaves will not. The Gemini (CPU PCB) which is mounted in the master sign, is linked to the master via an RS232 link, and uses the SiTOS protocol to communicate with the Master, the Master then passes on an necessary communication to the Slaves via the RS485 SiTOS link mentioned at the start of this paragraph.

Terminal block wiring

Table 1 shows the wired connections to the sign. For clarity each wire has been given a cable wire number although this is only used in this table. G01 to G02 represent the single 20 way data cable and A01 to A05 is the connections to the external AGD. The first colour of the data cable is the wire body colour and the second is the wire stripe.

Note that the wires +24V a.c. (Grey/Red) and -24V a.c. (Red/Grey) are used to feed power from the detector transformer at the base of the pole when using a 219 pole. The purpose of these is to provide a supply of 24V a.c. to power the AGD. These two wires are only connected to the terminal block when the AGD toroidal transformer is NOT fitted. If both transformers are fitted in an installation under no circumstances shall the outputs of both be connected together or permanent damage will result. In the unusual case when both transformers are provided the toroidal transformer shall be used and the 24V a.c. wires entering the sign shall be insulated and tied back.

Table 1 Graphos terminal block connections

Cable wire No.	Class	Terminal block label name	Function	External cable wire colour*	Internal connection
G01	Detector Inputs	COM	Common	Brown/Red	Gemini, PL5, 07
G02	Detector Inputs	IP1	BUFFER_I/P<1>	Brown/White	Gemini, PL5, 08
G03	Detector Inputs	IP2	BUFFER_I/P<2>	White/Brown	Gemini, PL5, 09
G04	Detector Inputs	IP3	BUFFER_I/P<3>	Orange/White	Gemini, PL5, 10
G05	Detector Inputs	IP4	BUFFER_I/P<4>	White/Orange	Gemini, PL5, 11
G06	Detector Inputs	IP5	BUFFER_I/P<5>	Blue/White	Gemini, PL5, 12
G07	Detector Inputs	IP6	BUFFER_I/P<6>	White/Blue	Gemini, PL5, 13
G08	Detector Inputs	IP7	BUFFER_I/P<7>	Green/White	Gemini, PL5, 14
G09	Detector Inputs	IP8	BUFFER_I/P<8>	White/Green	Gemini, PL5, 15
G10	Eng. Terminal	RXD	Receive Data	Red/Blue	Gemini, SK2, 02
G11	Eng. Terminal	TXD	Transmit Data	Blue/Red	Gemini, SK2, 03
G12	Eng. Terminal	DTR	Data Transmit Rdy	Red/Orange	Gemini, SK2, 06
G13	Eng. Terminal	GND	Ground	Orange/Red	Gemini, SK2, 07
G14	Eng. Terminal	VCC	+5 V d.c.	Red/Brown	Gemini, SK2, 09
G15	Spare		Spare 1	Grey/White	
G16	Spare		Spare 2	White/Grey	
G17	SITOS	DATA A	DATA_A	Red/Green	LSCU X10, 02
G18	SITOS	DATA B	DATA_B	Green/Red	LSCU X10, 03
G19	Not connected		+24V a.c.	Grey/Red	
G20	Not connected		-24V a.c.	Red/Grey	
A01	AGD	EARTH	Earth	Green	Chassis earth
A02	AGD	+24V a.c.	Supply +ve	Red	Toroid +
A03	AGD	-24V a.c.	Supply –ve	Black	Toroid -
A04	AGD	COM	Relay Common	White	LSCU X4, 1
A05	AGD	N/O	Relay N/O	Blue	LSCU X4, 3

* First colour is wire body colour second is stripe

4.14 168 BELLED POLE

This is the least expensive mounting solution. The 168 refers to the diameter of the base of the pole in millimetres. When installed there is only one cable that travels up this pole – the three core mains flex. Within the 168 base is the following equipment:

- Electricity company isolator
- Graphos double pole isolator switch and fuse (Graphos isolator)

The 168 pole is provided with a plywood backboard. The installation process is that the electricity company supplies their own isolator. This must be fitted with a fuse no greater than 25 A. This is fitted to the backboard in the first installation phase.

The second installation phase performed by the sign installation engineer is to attach the Graphos isolator to the top of the plywood backboard. The tails of the Graphos isolator will be connected to the electricity company's isolator and wire the sign flex to the output of the Graphos isolator. G39 safety precautions are required when breaking the circuit using the electricity company's isolator. These precautions are not required when removing the fuse or throwing the switch on the Graphos isolator.

For more detail see sections 11 Poles & 12 Foundations

4.15 219 BELLED POLE

The 219 belled pole provides the space for auxiliary equipment and connections within the base of the pole. When installed there can be up to four cables travelling up the pole; Communications Link cable, Graphos data cable, mains flex and PSTN cable. Within the 219 base is the following auxiliary equipment:

- Electricity company isolator
- Graphos double pole isolator switch and fuse (Graphos isolator)
- Remote engineer's terminal socket (25 way d-type)
- Graphos data cable terminal blocks
- Communications Link cable terminal blocks
- Detector transformer (24 V a.c.)
- Four channel loop detector card

All this equipment is provided as part of the Graphos MDU (Mains Distribution Unit) assembly. Note that although the 219 belled pole has the provision for a four channel loop detector card this card is shipped separately and has to be plugged into the MDU on site.

As with the 168 belled pole the electricity company isolator (commonly called the Lucy) isn't provided. There is a small piece of plywood provided for the Lucy on the MDU. With the 219 belled pole there is no plywood backboard provided in the pole, so the MDU has to be installed before the electricity company can install their Lucy isolator. This isolator must be fitted with a 25 A fuse.

For more detail see sections 11 Poles & 12 Foundations

4.16 GRAPHOS DATA CABLE AND COMMUNICATIONS LINK TERMINAL BLOCKS

The Graphos MDU comes pre-wired with all internal wiring between the elements provided on the MDU. Apart from the mains flex the only significant wiring is to the terminal blocks to connect with the Graphos data cable or Communications Link (if fitted). All the terminal block connections are marked on the terminal block bracket along with the colours of the wires. Figure 16 shows the bracket and terminal blocks viewed from the side.

The bracket is designed such that it can be removed completely from the pole base enabling access so the terminal blocks can be wired. The order of wiring should be the Graphos data cable and Communications Link cable first and then the loop feeder cables from the bottom of the MDU second. Generally field wiring is to the left of the terminal blocks with factory pre-wiring to the right side. Multiple holes are provided on the bracket to attach cable ties for strain relief of the cables. Armour for the feeder cables should be bent back and terminated with jubilee clip rings to the four slots at the base of the MDU. The armour termination method is the same as it is to the castellated bar in a traffic controller. The jubilee clip earth fixings are provided on the loop feeder cable kit.

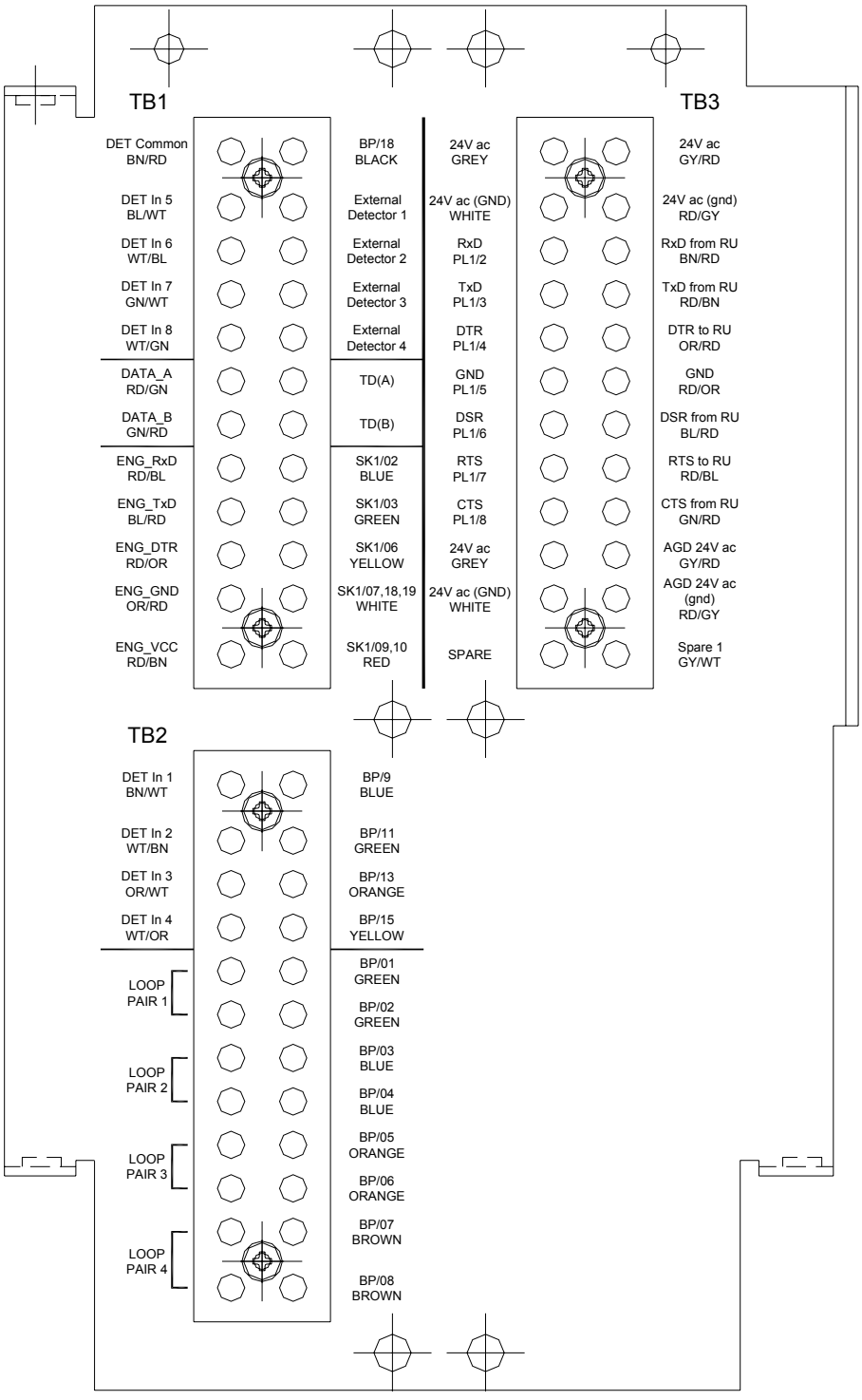


Figure 20 Graphos MDU terminal block bracket

Where an installation requires communications between the master sign and slaves an RS485 cable will be required.

4.17 MOUNTING BRACKET

To comply with the Highways Agency regulations all variable message signs must be capable of horizontal and vertical adjustment so the sign can be correctly orientated for best visibility. All Siemens Graphos signs have this facility provided by adjustable brackets. All signs in the Siemens Graphos family are held by a single pole.

There are three different mounting arrangements for the full range of Graphos signs. The mounting arrangement varies with the size of the sign. All three small sizes of Graphos sign use the Helios anti-impact device. This device permits horizontal adjustment of the sign but also includes a sacrificial impact device. If the sign receives a significant impact the horizontal adjustment mechanism breaks taking the force of the impact and protecting the sign. If a sign is loose on its mounting bracket and demonstrates significant horizontal movement it is likely this mechanism has fractured as a result of an impact. The anti-impact device should be replaced immediately.

4.17.1 BRACKET FOR SIGNS 500 X 625

This uses standard Helios “L” shaped signal head brackets. An AGD 200 ‘LiveWire’ can be mounted in the slot that runs the length of the top bracket. When using the Helios brackets the pole that the sign is to be mounted on must have holes drilled in it to receive the brackets. Both the smallest 168 and the 219 poles have these holes pre-drilled. There are four sets of holes at 90 degrees to each other around the circumference of the top of the pole.

When the 500 x 625 sign is mounted on a pole both brackets are fitted the same way up with the anti-impact device uppermost.

4.17.2 BRACKET FOR SIGNS 800 X 900 OR 650 X 700

Again both these two signs use standard Helios “L” shaped signal head brackets. An AGD 200 ‘LiveWire’can be mounted in the slot that runs the length of the top bracket. When using the Helios brackets the pole that the sign is to be mounted on must have holes drilled in it to receive the brackets. Both the smallest 168 and the 219 poles have these holes pre-drilled. There are four sets of holes at 90 degrees to each other around the circumference of the top of the pole.

When these two sizes of sign are mounted to a pole the top bracket is positioned with its AGD slot uppermost whilst the bottom bracket is inverted with its AGD slot at the bottom of the bracket.

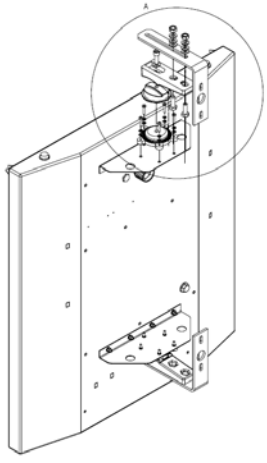


Figure 21 Bracket on a 800 x 900 Graphos sign

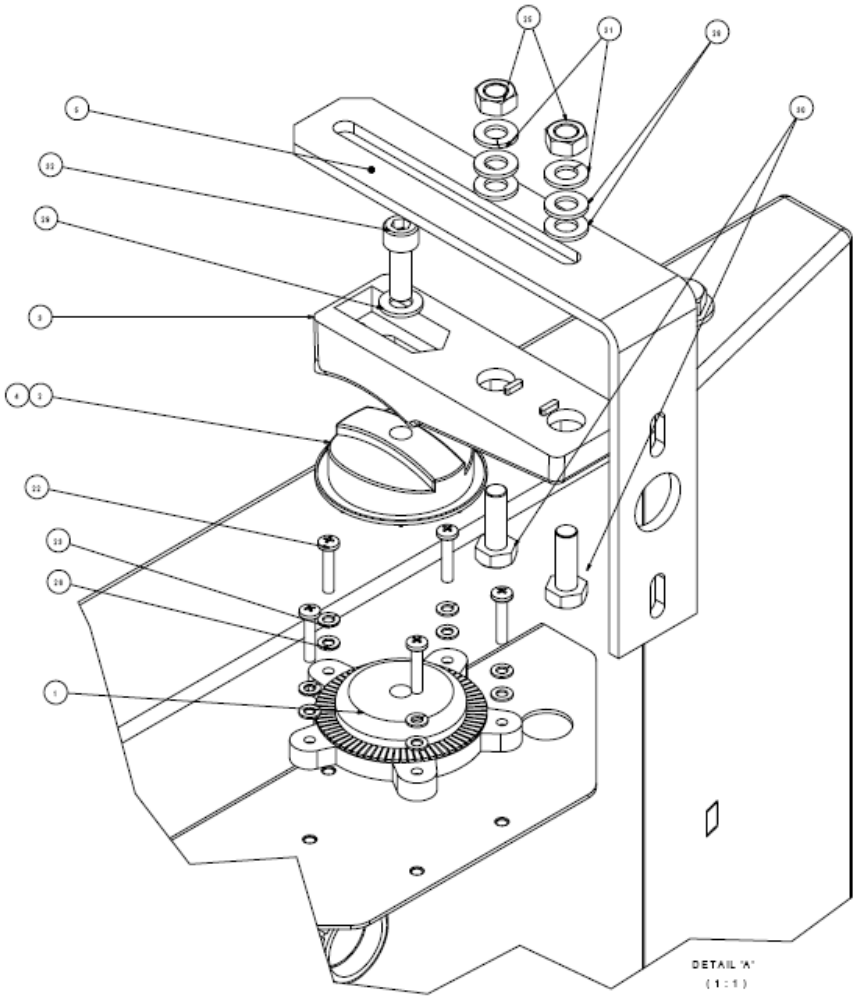


Figure 22 Graphos Sacrificial Cap detail

4.17.3 BRACKET FOR SIGNS GREATER THAN 800 X 900

Signs greater than 800 x 900 have a rail attached to their back. Into this rail slots the adjustable bracket. This bracket clamps to the pole with a yoke arrangement. There is no requirement for holes to be drilled into the pole to mount the bracket. The sign can be moved up and down the pole and rotated left and right to get the best position by loosening the yoke's grip of the pole. Declination adjustment is through a hinge mechanism built into the bracket. All adjustments of the bracket are performed with 13mm and 17mm A/F size spanners or sockets.

Optional elements

4.18 GRAPHOS GEMINI CPU

The Graphos sign has the capability of incorporating a Gemini CPU card. This offers enhanced functionality, including, but not limited to:

- Control and monitoring of a sign cluster that can include up to three Slave Graphos signs.
- Full RMS in-station integration.
- On site interrogation of the sign using standard handset commands.
- Fault monitoring and logging.
- In-station communications with power fail detection and last gasp dialling.
- Vehicle classifier functionality with up to eight loops (one detector in the 219 pole, one detector in a Haldo pillar).
- Activation of the sign or change of mode of operation at specific times of the day as set by a timetable held within the Gemini CPU.

A cluster is defined by a Master Graphos sign and up to three Slave Graphos signs.

Refer to the section in this handbook on sign operation for specific modes of operation (applications) in which the sign can be used. In all modes of operation the Master Graphos incorporates the Gemini CPU whilst the Slaves are without the Gemini.

The Graphos Gemini CPU card is a physically identical to the Gemini CPU card used in standard outstations. When used with a Graphos sign is makes use of the following interfaces:

- SK2 RS232 handset port to permit local engineering control and diagnosis of the sign with handset commands
- PL5 eight digital inputs (plus one common) to allow the Gemini to monitor external inputs such as loops, AGD, etc.
- PL4 an RS232 direct connection with the LSCU control board. This gives the Gemini CPU card control and allows monitoring of the core sign engine.
- PL3 provides Modem power (this can be switched on or off by Gemini if necessary)
- PL2 provides bi-directional RS232 communication with the Modem and hence the in-station.
- PL7 is the power connection for the Gemini CPU card. This connector is positioned on the underside of the card.

When a Gemini CPU card is fitted a supplementary PSU has to be provided to power the card. This is a 13.8 V 3” x 5” open frame modular power supply. When used in the Graphos sign a cover is provided for this PSU to protect the service engineer from contact with hazardous voltages. Power to the sign must be isolated before this cover is removed.

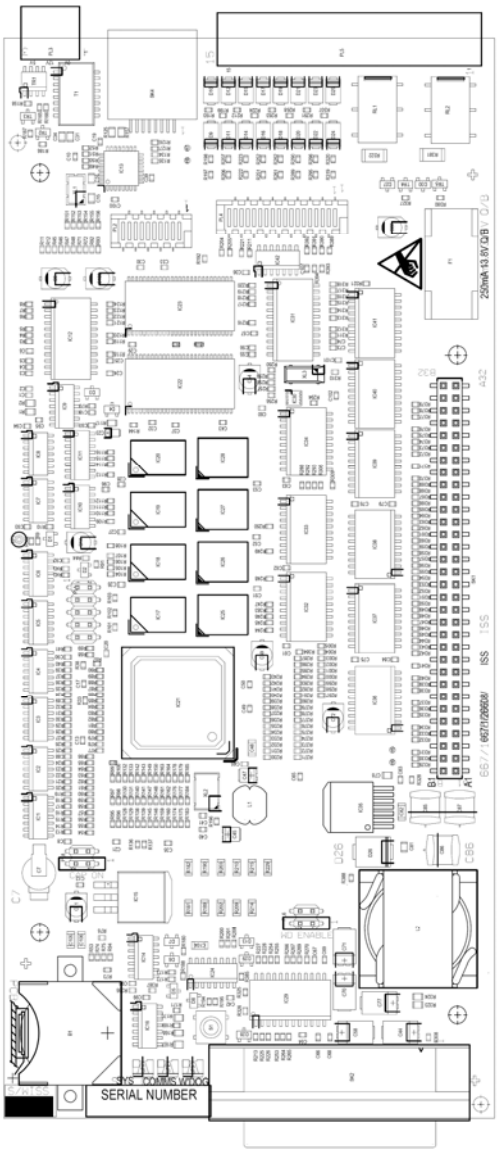


Figure 23 Graphos Gemini CPU card

In addition to these functions the Gemini CPU card has an optional LED acid battery to provide it with a reserve of energy in the event of a power outage. This battery is float charged in parallel with its PSU. Enough energy is provided by this battery to allow the Gemini CPU to support its modem and use it to communicate the power outage to the in-station. The battery has an in-line fuse that protects the battery against short circuits. The nominal battery voltage at its terminals (when not being charged) is 12 V d.c. if this measures less than 10 V d.c. the battery should be replaced.

4.19 MODEM

A modem can be only fitted within the sign when a Gemini CPU card is fitted.

4.19.1 PSTN MODEM

The Graphos sign can use a conventional Gemini PSTN modem for wired telephone communications with the in-station. The modem is powered directly from the Gemini CPU card. Note that the Dynalink modem has a additional power switch on it. Check the status LEDs are illuminated, if not the modem could be switched off. In the event of a power failure the power to the modem will be maintained by the Gemini's float charged lead acid battery.

4.19.2 GSM MODEM

The Graphos sign can use a standard Gemini GSM modem for wireless communications with the in-station. The modem is powered directly from the Gemini CPU. In the event of a power failure the power to the modem will be maintained by the Gemini's float charged lead acid battery.

Figure 24 Graphos GSM modem

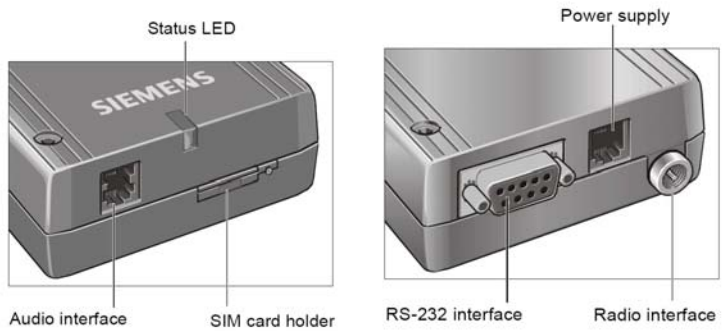


Figure 25 GSM modem interfaces

SIM card replacement
The SIM card is held in a draw on the front of the modem. To remove it use a sharp object such as a pen to press the latch on the right of the draw. The draw will pop out and the SIM card can be replaced. Figure 26 shows the replacement process.

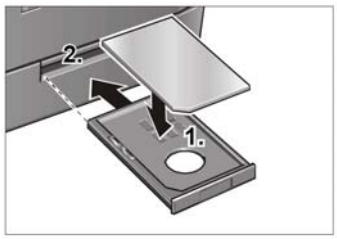


Figure 26 SIM card replacement

4.20 GSM ANTENNA

When a GSM modem is installed in the sign there is a GSM antenna fitted to the top of the sign. When not fitted this hole is blanked off with a sealed bolt.

A signal strength test should be performed prior to any site installation to ensure there is adequate radio reception to communicate with the sign.

4.21 REMOTE ENGINEER'S TERMINAL

There are three mechanisms for communicating with the engineers terminal when a Gemini CPU card is fitted. Note there is no engineers terminal mode with a sign not fitted with Gemini.

Direct connection
The handset terminal can be directly connected to the Gemini CPU. This is the non preferred method to diagnose problems as it requires the site engineer to open the sign and work at height. It is a useful feature though if the remote terminal wiring is suspected to be faulty or the engineer is already working on the sign at height.

Ground connection
The Gemini's handset is remotely wired to a socket housed in the 219 belled pole. To diagnose problems and communicate with the sign the door of the belled pole is opened and the handset is plugged into the socket on a flying lead attached to the MDU.

Bluetooth® connection
Bluetooth® remote engineering terminal is an optional feature that can be requested by the customer. The SieCom Bluetooth® module is fitted to the Gemini CPU. The antenna is mounted on the back of the Graphos sign housing. This has a guaranteed range of 10 metres line of sight communications. Typically this range is greater than this but is dependent on local conditions. To make use of this function the site engineer must have a Bluetooth® enabled engineers terminal.

Note that when the Bluetooth® engineers terminal is fitted the wired engineers terminal at the base of the 219 pole is disabled.

4.22 AGD & TOROIDAL TRANSFORMER

4.22.1 TOROIDAL TRANSFORMER

This is a low VA transformer intended to power the AGD with 24 V a.c. With a 168 pole it presents the only way to power the AGD but with a 219 pole there is the option of using this transformer (if fitted) or the detector transformer at the base of the pole. Note that when the base transformer is used the AGD remains powered when the Graphos double pole switch is thrown.

4.22.2 AGD

The AGD (Above Ground Detector) is the most common mechanism that the Graphos sign uses to identify over speed vehicles. The AGD 200 'LiveWire' used with the sign is part number 654/4/01114/000 (Manufacturer's part number AGD200-235-000 24v). The sign has a normally open input that is used to trigger the sign. When the AGD detects a speeding vehicle it activates an internal relay that shorts together its COM and N/O outputs. If the sign hasn't got a Gemini installed these signals are fed into the X4 connector of the control board. Where a Gemini CPU is fitted these signals are fed into the Gemini CPU card PL5 connector.

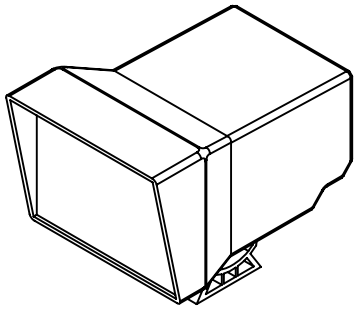


Figure 27 Typical Graphos AGD

Realise that the communication between the AGD and the sign is purely by a yes/no speeding vehicle detect signal. There is no ability to change the speed threshold within the sign when an AGD is fitted. To change the threshold the engineer must remove the access hatch on the AGD and communicate with the AGD directly with its 'LiveWire' interface.

4.22.2.1 Mountin g position of the AGD

The AGD is mounted on the top of the sign. For signs up to 800 x 900 mm in size it is mounted on the Helios bracket in the same way vehicle detection AGDs are fitted to signal heads. With signs that don't use a Helios bracket a supplementary bracket is required to mount the detector to the pole. When installing the sign and AGD the engineer should take note of vegetation that may obscure the AGD's view of the carriageway. This should be reported so it can be cut back or removed to ensure reliable operation.

The AGD should be mounted securely to its supporting structure. It shall be stable and free of excessive movement owing to wind. Any movement of the AGD could cause false detections.

It is possible that two radar based AGDs pointing directly towards each other at a separation distance of less than 40 m can cause mutual interference. Where possible ensure AGDs are not facing each other. If this can't be helped, ensure that the detectors concerned operate on different transmission bands. Refer to the AGD's handbook if in doubt.

4.22.2.2 Alignment of the AGD

The AGD kit comes with a pan and tilt mounting assembly. This allows the AGD to be adjusted in both declination (up/down) and azimuth (left/right movement) and locked in the selected position.

Installation is best performed in light traffic conditions where the zone of detection can be observed for individual vehicles using the LED indicator on the rear of the AGD. The AGD typically has a maximum range of 100 m. This distance is dependant on speed and type of vehicle and is not a guaranteed maximum. The AGD should be sighted to a point at the centre of the carriageway at the furthest point at which detection is required. For a dual-carriageway the AGD should be aligned with the road markings separating the two lanes at the furthest point of detection.

The AGD should be iteratively adjusted in both declination and azimuth until optimum performance is achieved. The cable to the detector should be fastened to the mounting structure with either insulating tape or UV stable cable ties (not natural nylon).

4.22.2.3 Configuration and setup of the AGD

All configuration parameters of the AGD can be adjusted using a PDA or laptop running the AGD configuration programme. All parameters held within the AGD are stored in non-volatile memory, so they are not erased if power is switched off.

Ensure the AGD is powered.

Plug the RS232 cable into the COM port of the PC or PDA.

Insert one end of the AGD interface adaptor into the RS232 Cable.

Undo the access port on the side of the AGD and insert the other end of the interface adapter (5-pin mini DIN end) into the exposed connector.

Upon connection the LED on the rear of the AGD will double flash repeatedly every two seconds.

Run the AGD configuration programme.

The typical configuration screen for the AGD software programme is shown in figure 17.

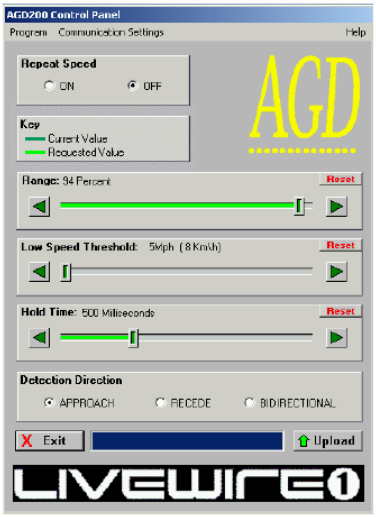


Figure 28 AGD configuration screen

Settings for operation of the AGD in conjunction with the Graphos sign are:

Repeat Speed
This function should be set to “OFF”. The purpose of this function is to communicate the speed of approaching vehicles using the AGD’s RS485 interface. The Graphos sign doesn’t make use of this function so it should be switched off.

Range
The range can be set for distances of up to 100 m but is dependant on target vehicle speed and size. The range parameter is adjustable between 0 and 100%, where 100% is approximately 100m. Assess where the intended detection zone is in relation to the sign and set an appropriate value. Note that the range adjustment is a non-linear scale i.e. setting the range to 50% will not result in half the average detection range of a range setting of 100%. The range setting may require fine tuning during test and alignment.

LST – Low Speed Threshold
This is the vehicle speed set in km/h. Vehicles travelling in excess of this speed will activate the sign. The low speed threshold is adjustable between 3 km/h and 250 km/h. Table 2 gives a conversion between km/h and mph. As a rule of thumb every five mph equates to 8 km/h.

Table 2 Miles per hour to Kilometres per hour conversions

Speed (mph)	Speed (km/h)
5	8.0
10	16.1
15	24.1
20	32.2
27	43.5
28	45.1
29	46.7
30	48.3
31	49.9
32	51.5
33	53.1
36	57.9
37	59.5
38	61.2
39	62.8
40	64.4
41	66.0
42	67.6
43	69.2
44	70.8
45	72.4

Speed (mph)	Speed (km/h)
46	74.0
47	75.6
48	77.2
49	78.9
50	80.5
51	82.1
52	83.7
53	85.3
54	86.9
55	88.5
56	90.1
57	91.7
58	93.3
59	95.0
60	96.6
61	98.2
62	99.8
63	101.4
64	103.0
65	104.6
66	106.2

Hold Time
The hold time of the AGD’s output relay once a speeding vehicle has been detected. The hold time is adjustable between 50 ms and 50 s This parameter should be set to the AGD’s default of 500 ms.

Detection Direction
This can be set to <Approach>, <Recede> or <Bi-directional>. For all Graphos applications where the AGD is mounted above the sign this must be set to <Approach>.

When all the parameters have been set press the upload icon to configure the AGD.

Remove the configuration adaptor and seal the AGD access port.

5 GRAPHOS OPERATION

The Graphos sign operates in two very different ways distinguished by the presence or absence of the Gemini CPU card. This next section of the handbook explains these modes of operation and the differences between them.

5.1 BASIC OPERATION (NO GEMINI PRESENT)

5.1.1 SPEED WARNING OR GENERAL PURPOSE WARNING OPERATION

This is the simplest mode of operation of a Graphos sign. The sign is activated by a switched normally closed connection. This is most commonly provided by an AGD attached above the sign monitoring approaching vehicles. When a Gemini CPU card isn't fitted the sign can neither be Master or Slave. It operates completely independently and doesn't communicate with any other sign or in-station. A Graphos sign operating in this way can be used to indicate the mandatory speed limit in force or the nature of hazard to an approaching vehicle. Note that the AGD doesn't have to be set to the speed limit of the road in question. It can be set to a particularly low detection threshold such that all approaching vehicles are warned of the hazard.

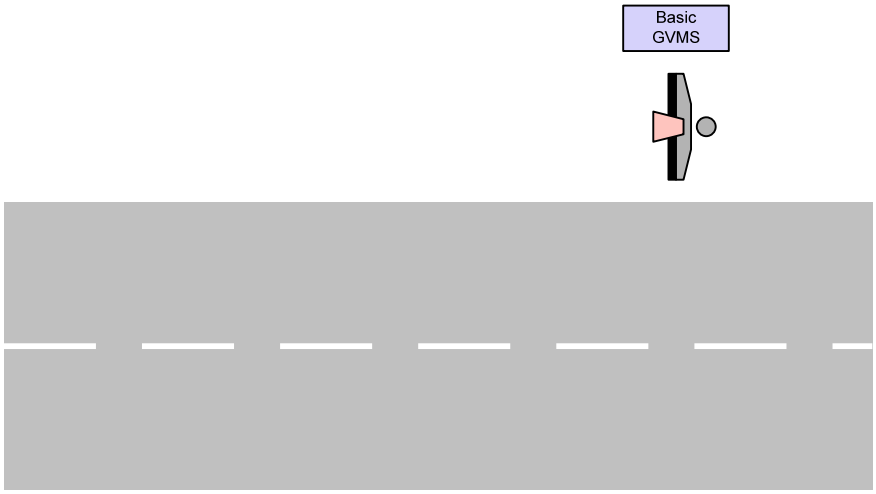


Figure 29 Graphos basic operation

A advance on this mode of operation is when a relay output from an AGD is shared between two signs. Note there is no direct communications between the signs, neither knows of the other's presence so this can not be considered to be Master/Slave mode. The AGD output is connected in parallel on the terminal block in the Graphos sign with the AGD mounted above it. The cable is ducted across the road to the second sign and fed into its AGD COM and N/O terminal block inputs.

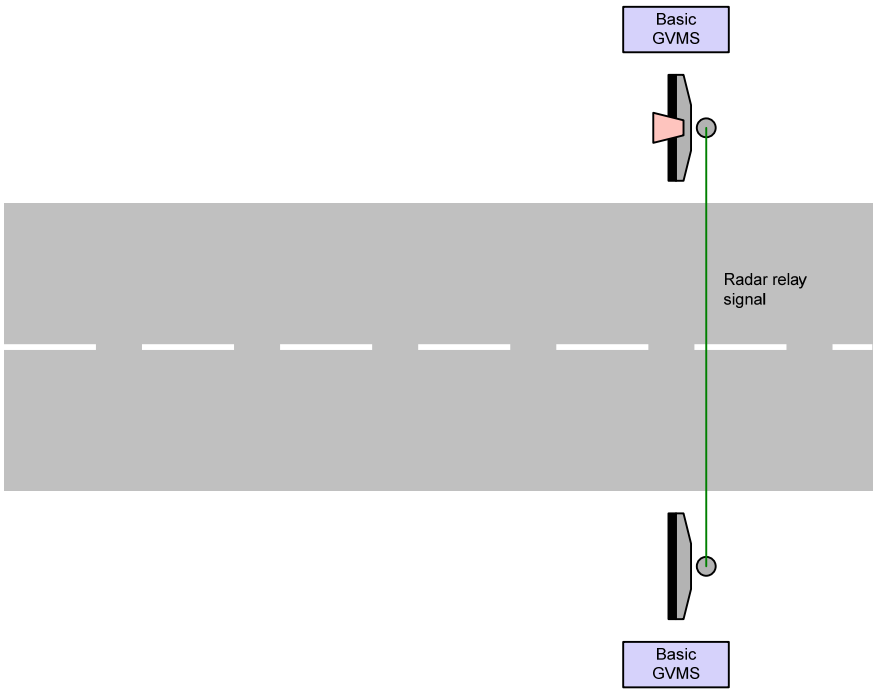


Figure 30 Graphos basic operation with two signs and one AGD

Sign on duration in response to vehicles
When a vehicle approaches the sign the AGD holds its relay closed for its hold time. Typically this is set for 500 ms. The Graphos sign in response to this input activates the sign for a period t. In basic mode t is set by the configuration plug (in enhanced Gemini operation by the RMS in-station). When two vehicles are detected exceeding the speed limit and the distance between them is small the second vehicle will pass the sign during the activation for the first vehicle. In this situation if the second vehicle is detected at the end of the display period t it may only have a fleeting glimpse of the sign before the display is switched off. The Graphos sign can be configured to remember up to one vehicle detection event whilst it is displaying an aspect. After the first vehicle display it will pause with the display off before then re-activating itself in response to the second vehicle. This pause time is important as it indicates to the vehicle that the sign has been re-activated. The off pause time is part of the sign factory configuration and can't be changed in the field.

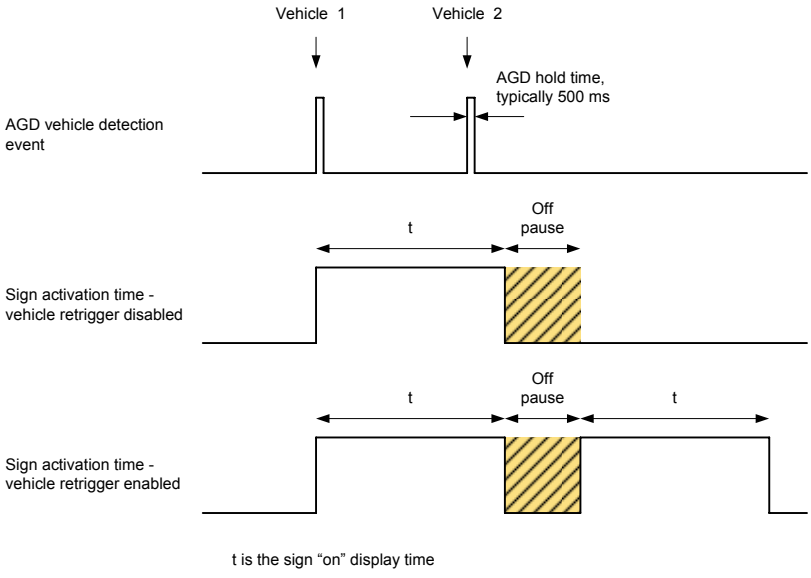


Figure 31 Graphos activation time

5.2 ENHANCED GEMINI OPERATION

5.2.1 SPEED WARNING OPERATION

In speed warning operation the Gemini CPU can determine the speed of vehicles either by its subterranean loop inputs or by being fed an over speed detection signal from an AGD. In the later mode of operation the Gemini isn't capable of changing the speed threshold at which it detects speeding vehicles. This threshold is set and stored within the AGD.

5.2.1.1 Speed warning operation with loops

The Gemini CPU monitors its loop inputs and assesses when over speed vehicles are approaching the sign cluster. When an over speed vehicle is detected the appropriate SiTOS message is sent to the Master Graphos control board to request an aspect to be displayed.

The Master Graphos control board signals a message to the Slave sign via the SiTOS RS485 communications link. (Note: There can be a small delay, less than 50 ms, between the Master and the Slave Signs illuminating, testing has shown that this delay is unobtrusive).

A predetermined amount of time later another SiTOS message will be sent to blank the display.

The vehicle speeds are assessed by the Gemini vehicle classifier facility, which is configured by the RMS in-station.

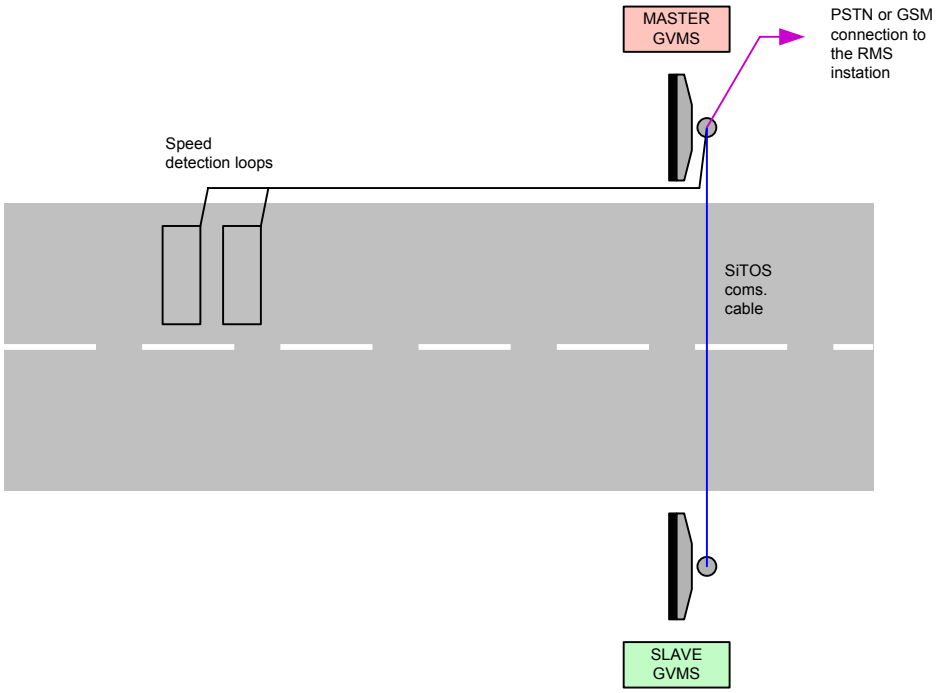


Figure 32 Typical speed warning operation with speed detection loops

A further development of this mode of operation is where speed detection loops are used in front of each sign. Both loops pairs are fed into the Gemini CPU held in the Master. The Master activates itself or the Slave in response to a high speed vehicle approaching from either direction. Figure 12 shows the physical arrangement when this mode of operation is used in practice.

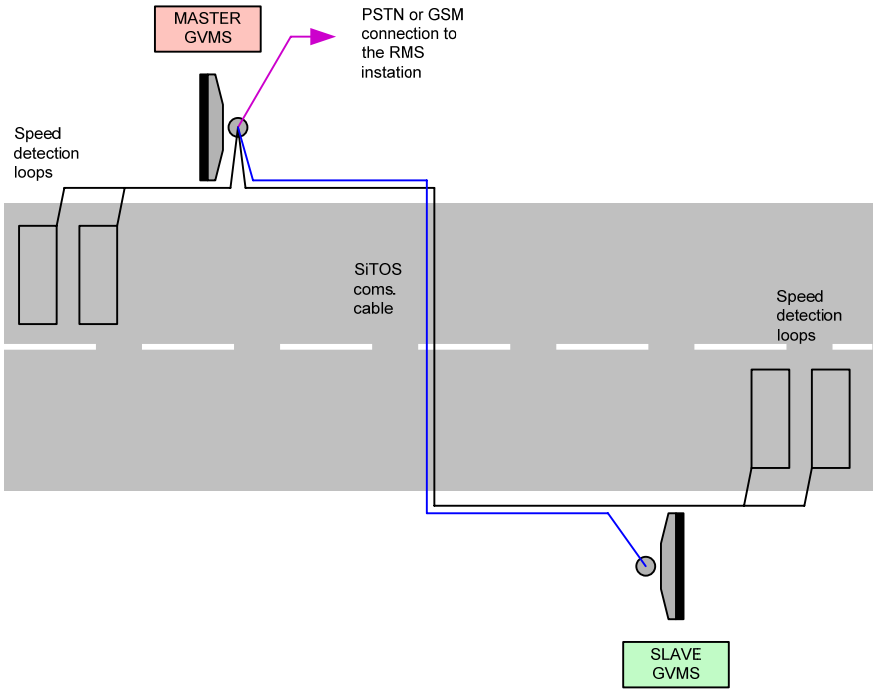


Figure 33 Speed warning operation with two pairs of loops

5.2.1.2 Speed warning operation with an AGD

Speeding vehicles are detected by the AGD connected directly to the Gemini CPU card in the Master Graphos. Note that this is very different to installations without Gemini where the AGD relay output is fed into the Graphos control board, here the Gemini uses its intelligence to decide how to react to the detection based on its RMS in-station configuration. Up to two AGD outputs can be connected to a Gemini CPU controlling up to one Master and three Slave signs. The speed thresholds are set and stored within the AGD, not within the hardware in the sign enclosure.

The timings of the sign displays are controlled by each Master or Slave's LSCU control board (e.g. sign illumination period, blank time, re-trigger inhibit etc). The Gemini unit, using the values configured at the RMS in-station, can override the default configuration settings in the LSCU control boards in its cluster.

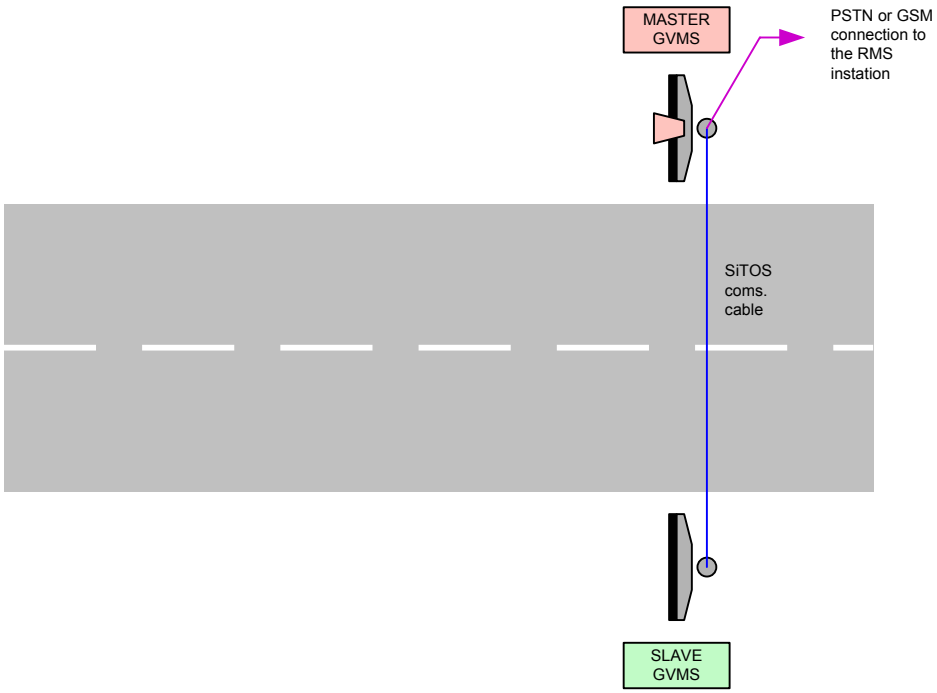


Figure 34 Speed warning operation with an AGD

In the example below, loops have been installed so that the Vehicle Classification facility in the Gemini unit can be used to log vehicle statistics and determine the effectiveness of the installation.

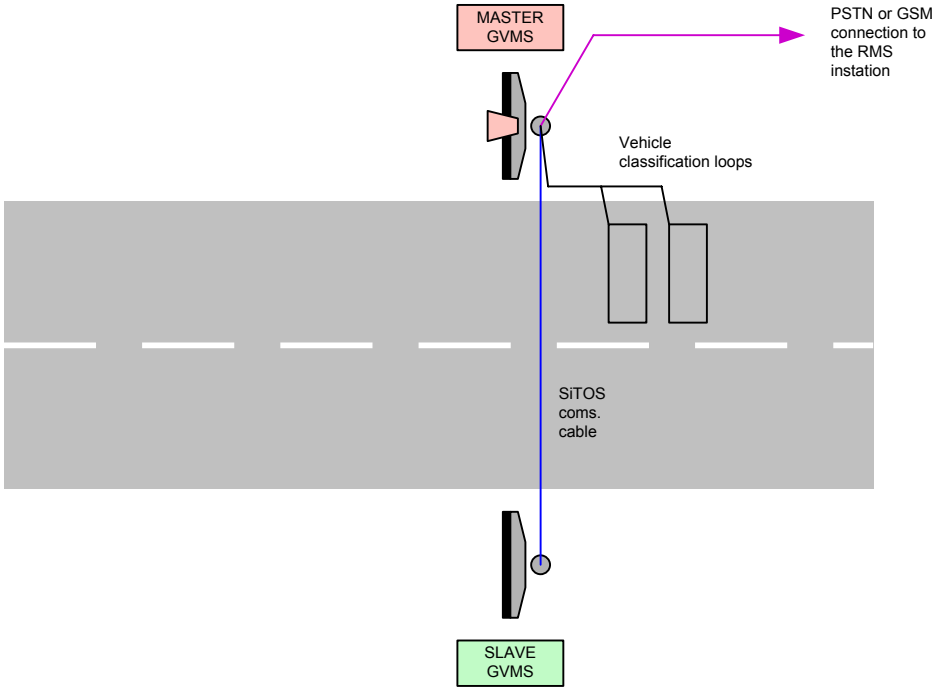


Figure 35 Speed warning operation with an AGD and vehicle classifier

5.2.2 VARIABLE SPEED LIMIT OPERATION

With a Gemini enhanced Graphos sign it is possible to operate a variable speed limit system where speed limits are set dynamically by the in-station or from a static timetable held within the Gemini CPU in the Master sign.

A message is sent between the Gemini CPU and the Master LSCU control board to set one of four display aspects.

The Master LSCU control board relays the message to its Slave signs via the SiTOS communications link.

Once the message has been sent and acknowledged by the LSCU control boards in the signs this picture is displayed until another message is sent to return the sign back to the original display.

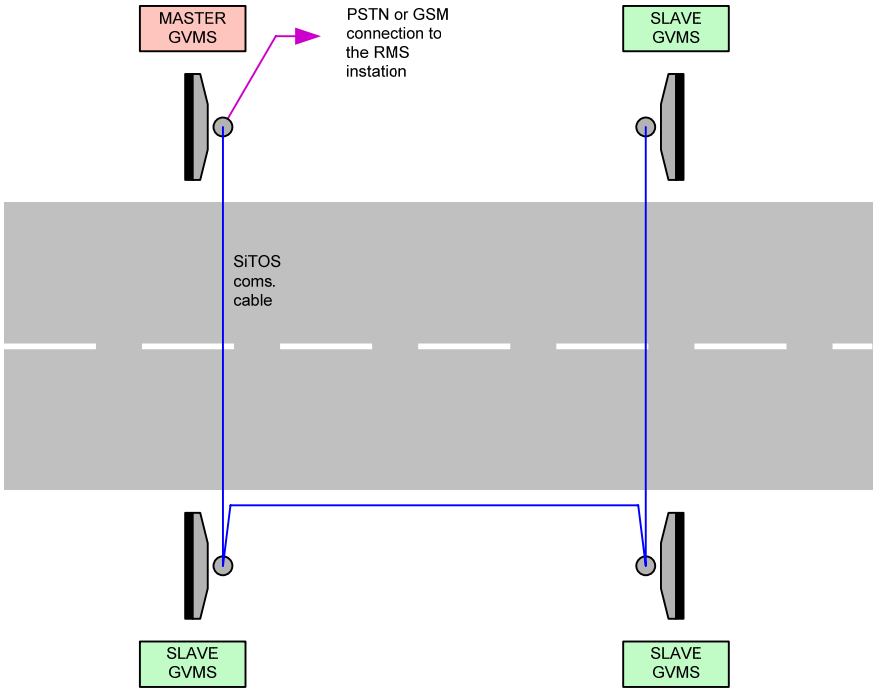


Figure 36 Variable speed limit operation

5.2.3 COMBINED VARIABLE SPEED LIMIT AND SPEED WARNING OPERATION

During times when the signs are not being used to enforce a speed limit they can be used as speed warning signs. Vehicle speed detection can be achieved by either an AGD or speed measurement loops.

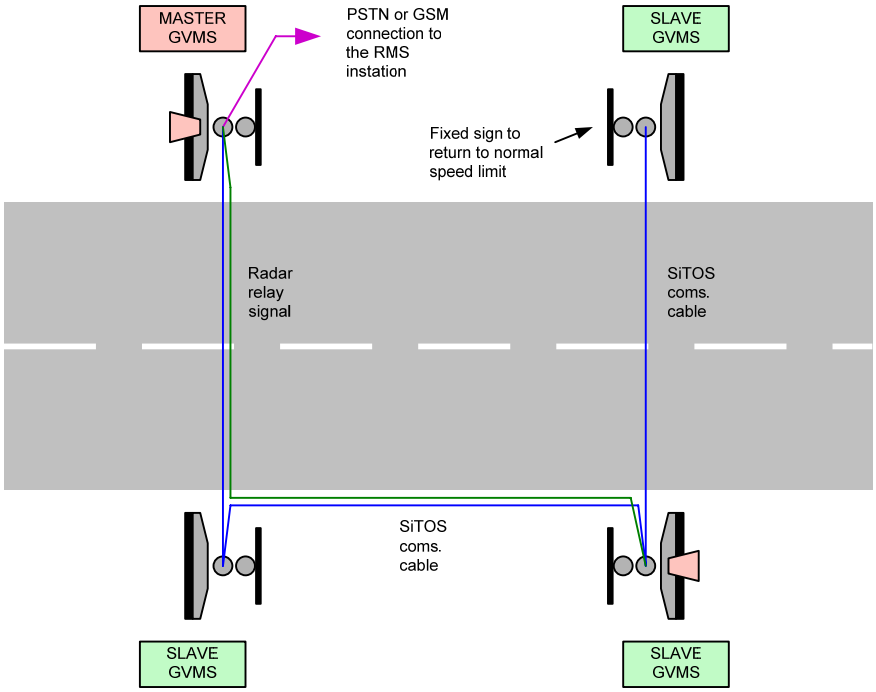


Figure 37 Combined variable speed limit and speed warning operation with two AGDs

5.2.4 GENERAL PURPOSE WARNING SIGNS

General purpose warning signs are operated in a similar manner to the speed warning signs except that their purpose is to alert the driver to a potential hazard, e.g. sharp bend, junction ahead, roundabout etc. The hazard warning could be displayed when any vehicle is detected and not just a speeding vehicle.

5.2.5 REMOTE DISPLAY SETTING

When controlled by the Gemini CPU the Graphos display can be overridden from the RMS in-station using the Event Switch Override facility. This setting has the highest priority and will remain illuminated until this override is removed. An event could typically be high winds, road closed, ice etc.

5.2.6 LOCAL MANUAL DISPLAY SETTING

When controlled from the Gemini CPU the Graphos display can be set locally using the handset SGM command. The display is restored to automatic control when the next local event occurs, e.g. timetable entry.

Note: The handset can only set the sign(s) if the Switch Override facility is inactive.

6 SOFTWARE CONFIGURATION

6.1 GRAPHOS LSCU CONTROL BOARD CONFIGURATION

The LSCU control board (also referred to in this section as the LSCU) has two main software elements, the configuration (VRSG), and the application (VAS). The configuration contains data that is specific to the particular build of the sign for example one part of the configuration deals with the mapping of the LED strings to the control logic. The application is the software that controls the sign and its behaviour. The application remains generic to all sign types and uses the configuration data to determine the individual sign behaviour.

The LSCU control board also provides a means of configuration via the configuration plug. This mechanism allows for the easy changing of certain configuration items, typically items that may require ready adjustment for example the sign display on time.

6.1.1 CONFIGURATION (SIGN DATA)

The configuration is matched to a specific sign as it contains data about the colours used and the sign faces that can be displayed, and how they can be displayed. These are edited and generated at the time of original manufacture in Poole. On the label inside the sign an STC part number for the sign can be found 667/1/32???/???. From this part number the configuration data can be found (explained in detail in the coming sections), and re down loaded as necessary. Note after downloading the configuration file it is necessary to re-load the application file.

6.1.2 CONFIGURATION FILE DEFAULTS

- Flasher Rate:
  400mS On and 400mS Off.

- Time On (length of time that the sign remains on after trigger, variable by config plug):
  2 seconds.

- Time Off (length of time that the sign must be off before it can re trigger):
  1 second.

- Default Luminance Level :
  5000 Lux.
  This value was chosen as it was thought to be a middle value, somewhere between fully bright and fully dim. It would be useful to see what it actually looks like on a sign.

- Default picture:
  '1'.

- Warning Mode Retrigger Disable Interval:
  100%.
  This means that the sign will not retrigger while it is already on.

• **WarningModeOffTime:**

Defines the minimum off time for the sign in increments of 100mS e.g. WarningModeOffTime = 10 defines a 1 second minimum off time for the sign.

• **WarningModeRetrgDisableInterv:**

Defined, as a percentage of the sign on time, the time for the sign to ignore further trigger events during activation. Normally this would be set to 100, so that the sign ignores any trigger events whilst it is activated. The figure 38 illustrates the behaviour for values of 100 percent and 50 percent.

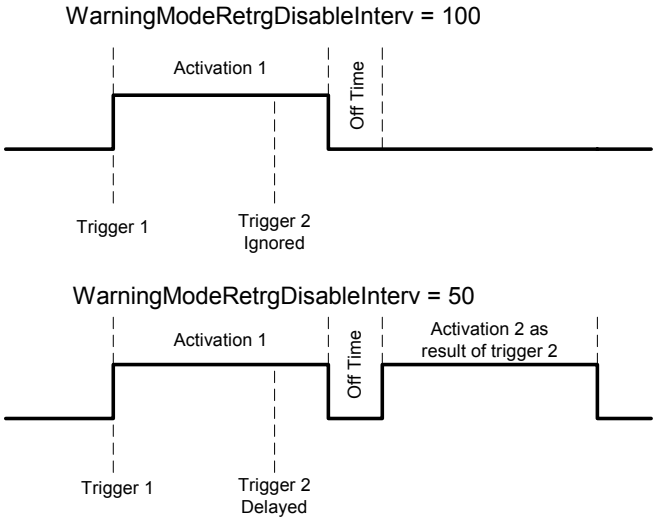


Figure 38 Warning mode retrigger behaviour

6.2 SOFTWARE DOWNLOADING APPLICATION

A Java based Tool is available to run on any P.C. or PDA with a Java Engine installed and enabled. For STC Employees it is available to download from the Intranet, and is contained in the same server structure as the sign configurations, in a folder named “Graphos Download Tool”. This folder contains files in a directory structure which matches that found on a target PDA or PC, the files simply have to be copied from the folder and sub folders to the same sub folders on the target PDA / PC,.

Note Java Engines are freely available for a P.C. to download from the net and can normally be found on the support web site for the appropriate P.C. manufacturer. For PDAs only licenced engines are available for the recommended (supported PDAs listed below) a proprietary Java engine from “CrEme” is available either directly from their website (www.nsicom.com) for an appropriate licence fee or can be obtained through STC.

To install the CrEme Java engine. Firstly connect the PDA to the PC (as the install will normally detect the PDA and give you the option to install on to it. Then run the install executable “CrEme326_ARM_CE42_PPC.exe”. If installing to the PDA does not appear as an option, then you should access the programme on the P.C. from the PDA in the manner that you would normally use to install new software on the PDA from a P.C.

JRE refers to Java Runtime Engine

6.2.1 PDA INSTALLATION

1) Connect the PDA to a PC with the NSIcom CrEme V3.26 environment installed. Connect the PDA to the PC via a serial / USB cable. On connection the NSIcom installer will install the CrEme JRE onto the PDA.
2) Unzip the files contained in 667_FZ_32100_000.zip and save in directory My Device\Windows\CrEme\lib on the PDA.
3) Move the GVMSProgrammer shortcut (GVMSProgrammerSc.jar) to My Device\Windows\Start Menu.

GVMSProgrammer will now be available from the start menu on the PDA.

6.2.2 LAPTOP INSTALLATION

To run on a laptop it must have both a JRE and javax.comm installed. Javax.comm can be downloaded from javax.comm_download

On acquiring the javax.comm package install in the files in the JRE directory as follows:

1) Place comm.jar in directory Program files\Java\jre1.xxxx\lib\ext
2) Place javax.comm.properties in directory Program files\Java\jre1.xxxx\lib.
3) Place win32com.dll in directory Program files\Java\jre1.xxxx\bin.
4) Place GVMSProgrammer.jar in a directory of your choice.
5) Click on GVMSProgrammer.jar to execute.

6.3 CONFIGURATION AND APPLICATION DOWNLOADING

6.3.1 CONFIGURATION TOOLS

6.3.1.1 A PDA with RS232 port and 3 metre serial interface cable.

This device should be battery operated (due to the likelihood that there will be no mains supply available from the sign) and will have the Graphos Download Program installed.

6.3.2.1 A Siemens laptop with RS232 port and 3 metre (9-way male 'D' to 9-way female 'D' straight through) serial interface cable.

This device should be battery operated (due to the likelihood that there will be no mains supply available from the sign) and will have the Graphos Download Program installed.

Note: Most modern laptop's have no RS232 ports but have USB ports, if using one of these laptops a USB to RS232 dongle will be required.

6.3.3.1 Configuration storage media:

Where the sign is installed in a remote location and / or short repair times are required it may be considered necessary to store the configuration and firmware locally within the sign. Storage media suitable for the tools in use locally on the maintenance contract will be required with a capacity of at least 600 KB, to allow for the storage of both the configuration data files and application firmware. The configuration data, firmware and Graphos Download Program are freely available from STC upon request, please quote sign type number 667/1/37xxx/xxx, noted on the label inside the sign (to select the correct sign configuration data). This can be delivered by email or on CD by post. Please contact Ian Knight at Poole on (01202) 782199.

6.4 CONFIGURATION AND APPLICATION SOFTWARE DOWNLOAD PROCEDURE

A laptop or PDA is required to carry out this function. All engineers involved in the maintenance of Graphos signs will need to setup their own directory structure and naming convention on the laptop / PDA to be used for download, the required naming convention is given below and is referred to throughout this download procedure.

6.4.1 GRAPHOS DOWNLOAD PROGRAM SETUP AND DIRECTORY STRUCTURE

Ensure, prior to carrying out the download process, that you have the Graphos Download Program installed on your laptop / PDA.

To obtain a copy of the Graphos Download Program please contact Ian Knight at Poole on (01202) 782199.

To install the program on your laptop / PDA please refer to section 6.1.3 of the Graphos Product Handbook (667/HB/31200/000) and follow the instructions.

The following directory path and naming convention should be setup on your laptop / PDA and the Configuration and Application Firmware files, referenced below, should then be copied from the TIE server in to this directory.

Products\Graphos\Download>	This directory should contain the following files:-		
	VAS.H86	----	Application H86 file.
	VRSG.H86	----	The config H86 file.

Note: To copy these files from the TIE server to the Download directory on a PDA you will need to connect your PDA, via a cradle, to a PC / laptop that is connected to the network.

6.4.2 ACQUIRING SIGN CONFIGURATION DATA AND APPLICATION FIRMWARE FROM THE TIE SERVER

The VAS.H86 and VRSG.H86 files should be obtained (copied) from the TIE server to the <Products\Graphos\Download> directory on your laptop / PDA.

6.4.2.1 Ensure you have the part number of the sign you need to acquire the Configuration Data and Application Firmware for. All signs will have a part number label, located on both the underside and within the sign itself, with this information on.

6.4.2.2 Log on to the network and navigate to <***Ples601a\TIE\Graphos for Production and FS\Configuration Data***> and locate the directory with the same naming convention as the sign label part number e.g. 667_CF_31200_000_**Iss2**.

Note: It is important that you select the directory with the latest issue number, in this case _**Iss2**.

6.4.2.3 Copy the Configuration Data file (VRSG.H86) from this directory to the <Products\Graphos\Download> directory on your laptop / PDA.

6.4.2.4 Navigate to <***Ples601a\TIE\Graphos for Production and FS\Application Firmware\Current Version***>

6.4.2.5 Copy the latest version, Application Firmware file (VAS.H86), from this directory to the <Products\Graphos\Download> directory on your laptop / PDA.

6.5 REVIEW PROCEDURE

6.5.1 Establish a connection between the Laptop / PDA and the LSCU by connecting:

a). An RS232 9-way male 'D' to 9-way female 'D' serial interface cable from the laptop to connector X5 on the LSCU.

b). An RS232 serial interface cable from the PDA to connector X5 on the LSCU.

Important Note:

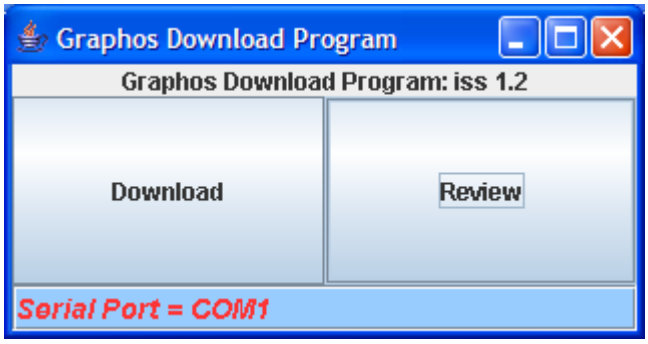
- The laptop serial interface cable should be a standard 9-way male 'D' to 9-way female 'D' straight through type.
- The PDA serial interface cable will be dependant on the PDA model type and Operating System used.

At present the only PDA model types tested and approved for this purpose are the HP Ipaq and Pocket Loox 718, using a ruggedised Socket ® serial I/O CF card.

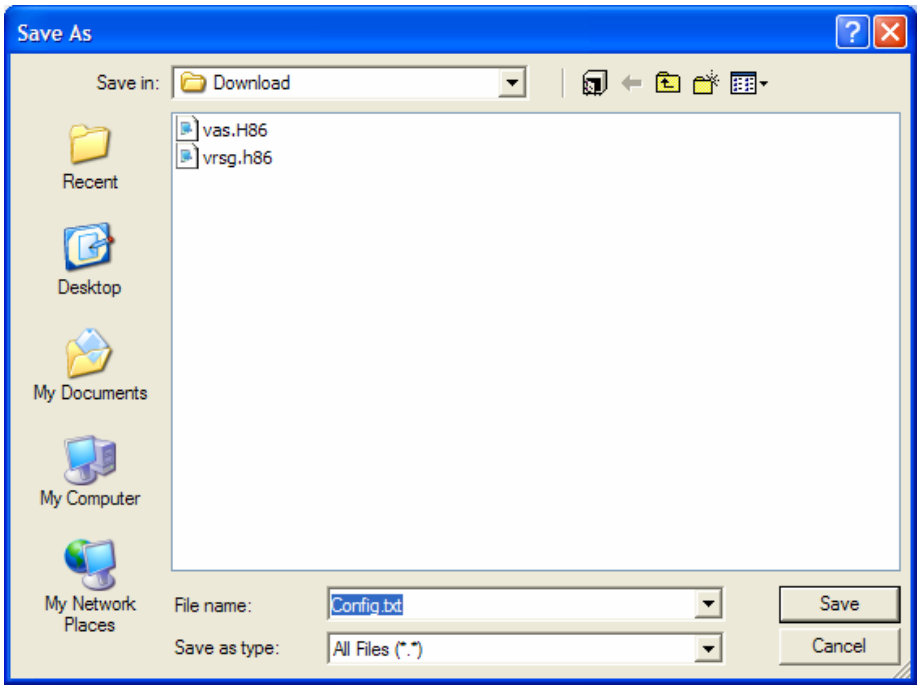
For serial interface connectivity of other PDA model types Engineering assistance will be required. In this instance please contact either Ian Knight on (01202) 782199 or Phil Roberts (01202) 782416.

- All PDA's should be encased in a ruggedised cover to protect them from both damage and the effects caused by the environment they are used in.

6.5.2 Execute the Graphos Download Program, the following main menu window will appear on screen.

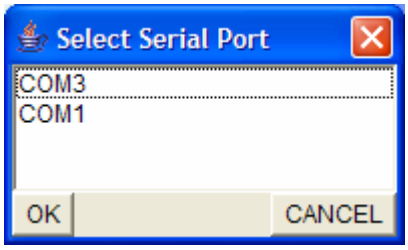


6.5.3 On clicking the **"Review"** button a file dialog box with the heading ***'Save As'*** will appear, this allows the Configuration Data only, to be saved to a pre-defined directory (i.e. Products\Graphos\Download>), on your laptop / PDA.
This file is output in text format with a default name of *'Config.txt'*.


Save As
Save in:
Download
vas.H86
vrsg.h86
Recent
Desktop
My Documents
My Computer
My Network Places
File name:
Config.txt
Save as type:
All Files (*.*)
Save
Cancel

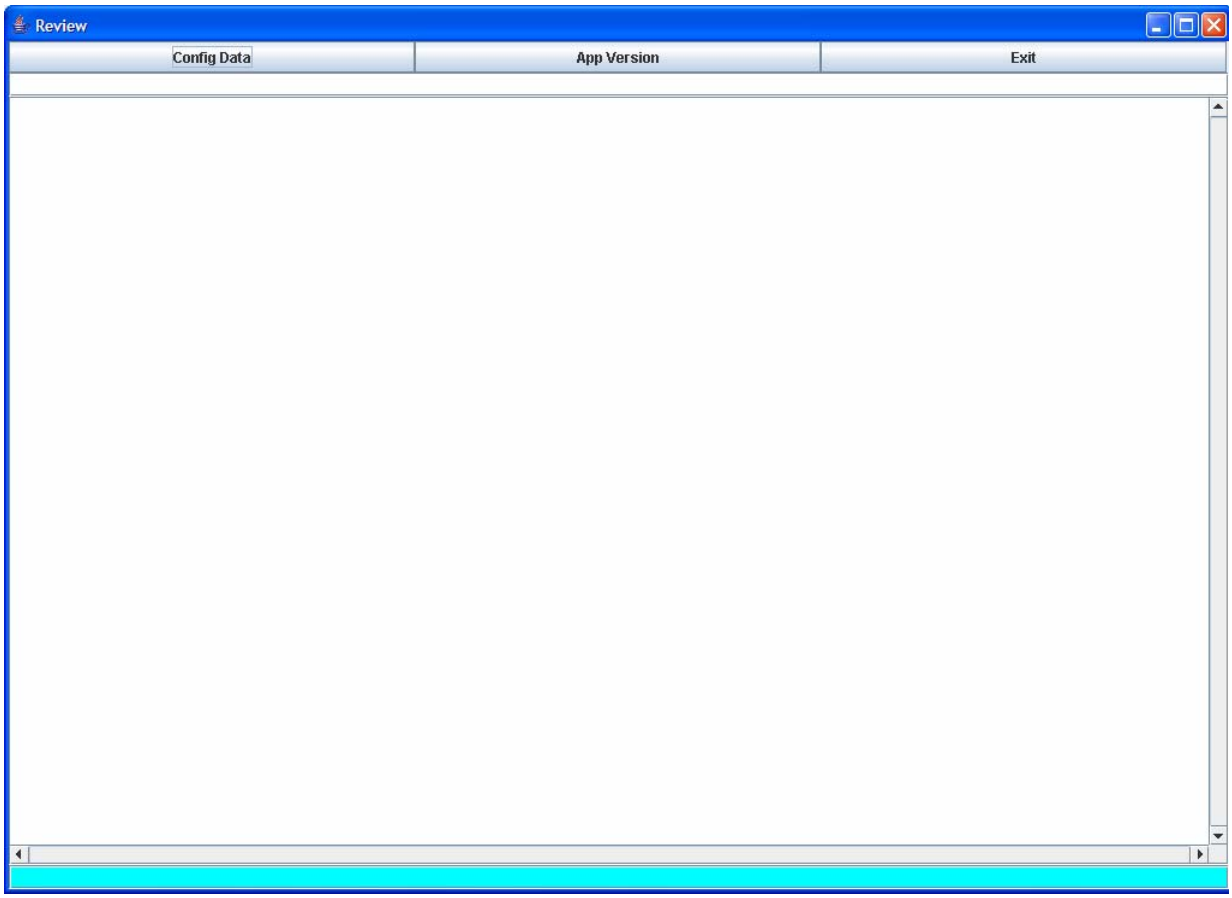
When happy with the filename and the directory it is to be saved in, click **'Save'**.
If no file output is required click **'Cancel'**.
Note: The filename can be changed to suit the individual.

6.5.4 A dialog box will now appear asking you to ***'Select Serial Port'***.

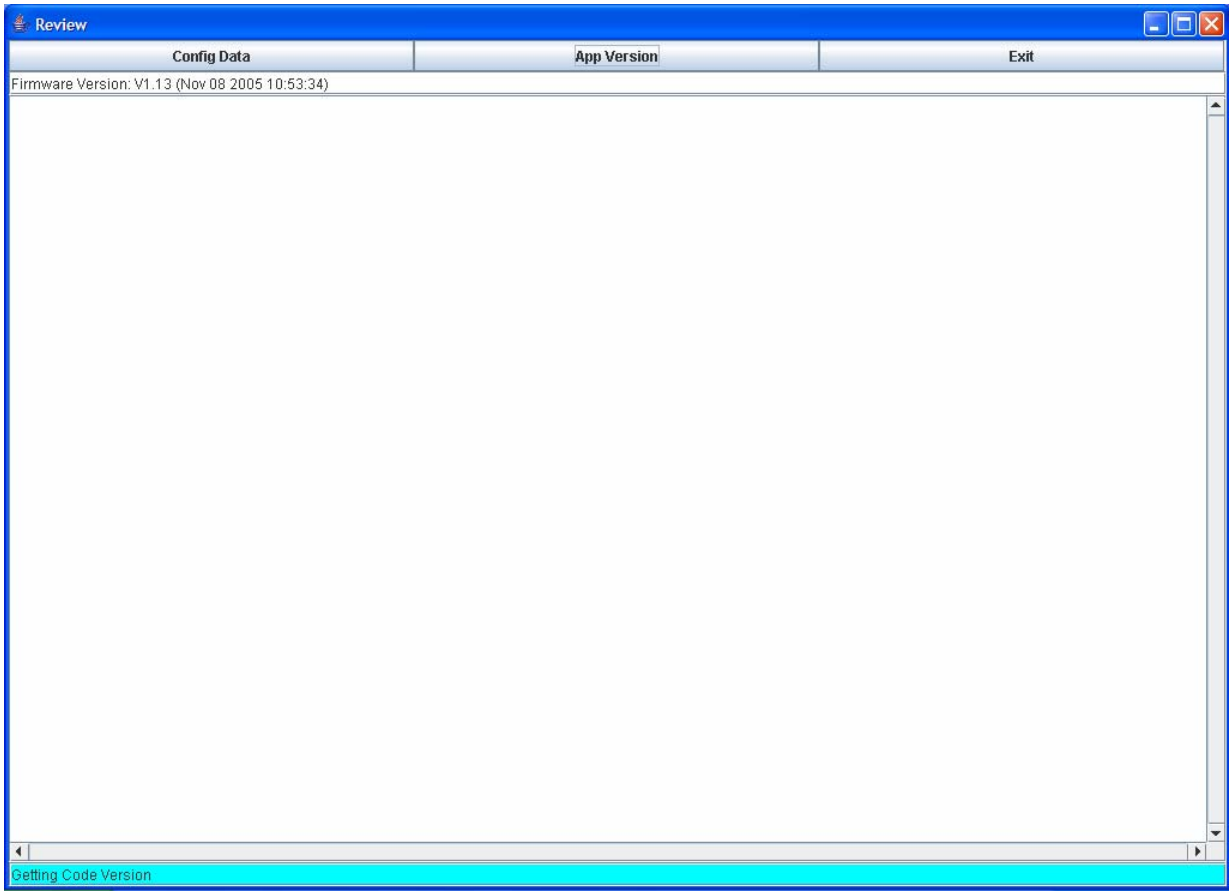


Select the required COM Serial Port from the drop down list and click **"OK"**.

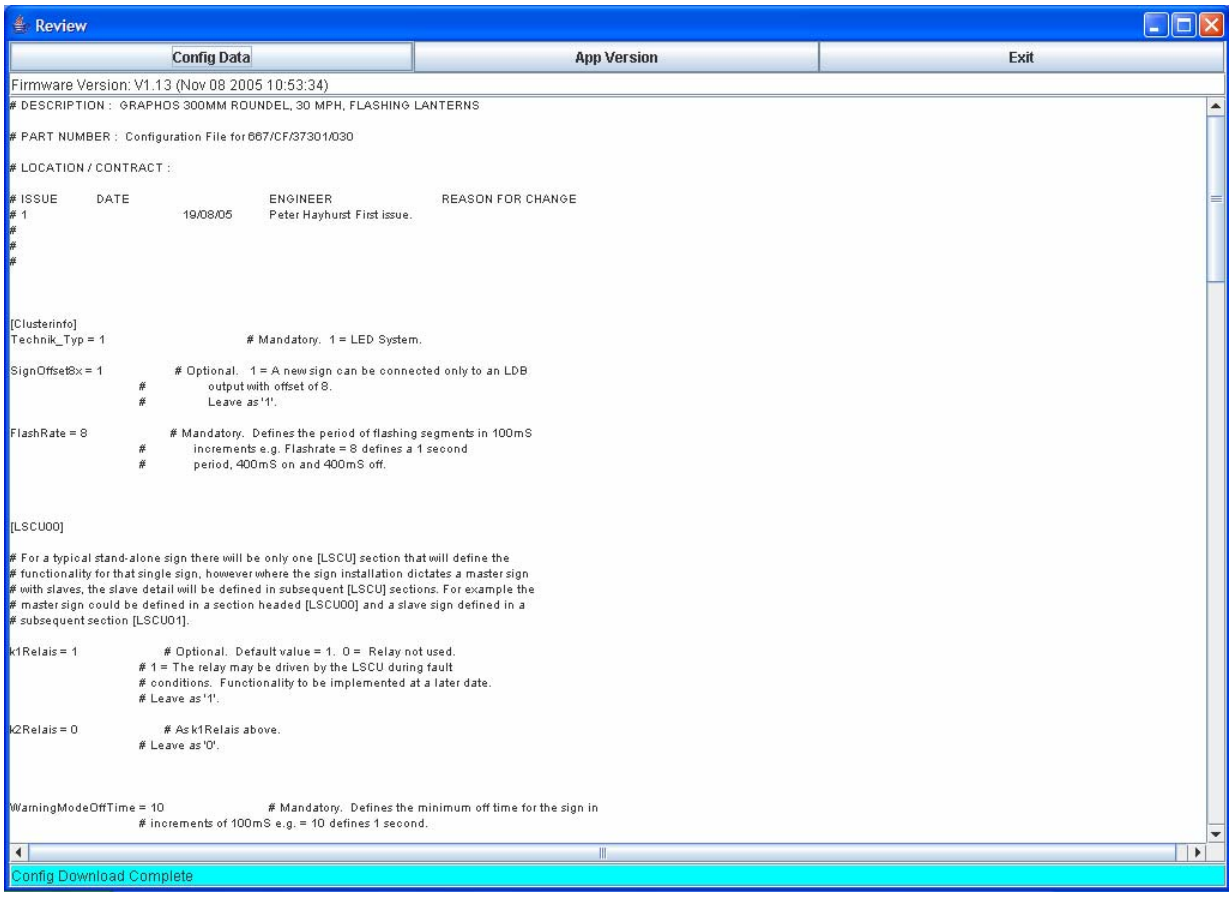
6.5.5 The ***'Review'*** dialog box will now appear as follows:-



6.5.6 To display the Application Firmware Version click the **'App Version'** button at the top of the ***'Review'*** dialog box. The following information should now be displayed:-



6.5.7 To display the Configuration Data click the **'Config Data'** button at the top of the ***'Review'*** dialog box. The following information should now be displayed:-



Note: The full context of the displayed configuration file can be viewed by using the scroll bars. Selecting the **'Config Data'** option also saves the Configuration Data to a text file, if previously selected to do so (see step **2.3.3**).

6.5.8 Once the required review(s) have been completed and no downloads are required, close down the program and disconnect the interface cable between the laptop / PDA and the LSCU.

6.6 *DOWNLOAD PROCEDURE*

6.6.1 Before carrying out the Download function please be aware of the following:

a) If downloading Configuration Data to the sign, then it is necessary to download the Application Firmware immediately after.
b) If downloading Application Firmware only to the sign, then it is not necessary to download the Configuration Data as well.

6.6.2 Power off the sign.

6.6.3 Fit the Download link to X13 on the LSCU.

6.6.4 Power on the sign.

6.6.5 Establish a connection between the Laptop / PDA and the LSCU by connecting:
a). An RS232 9-way male 'D' to 9-way female 'D' serial interface cable from the laptop to connector X5 on the LSCU.

b). An RS232 serial interface cable from the PDA to connector X5 on the LSCU.

Important Note:

- The laptop serial interface cable should be a standard 9-way male 'D' to 9-way female 'D' straight through type.
- The PDA serial interface cable will be dependant on the PDA model type and Operating System used.

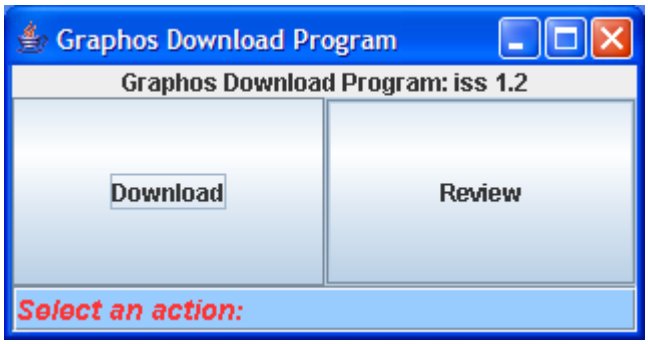
At present the only PDA model types tested and approved for this purpose are the HP Ipaq and Pocket Loox 718, using a ruggedised Socket ® serial I/O CF card.

For serial interface connectivity of other PDA model types Engineering assistance will be required. In this instance please contact either Ian Knight on (01202) 782199 or Phil Roberts (01202) 782416.

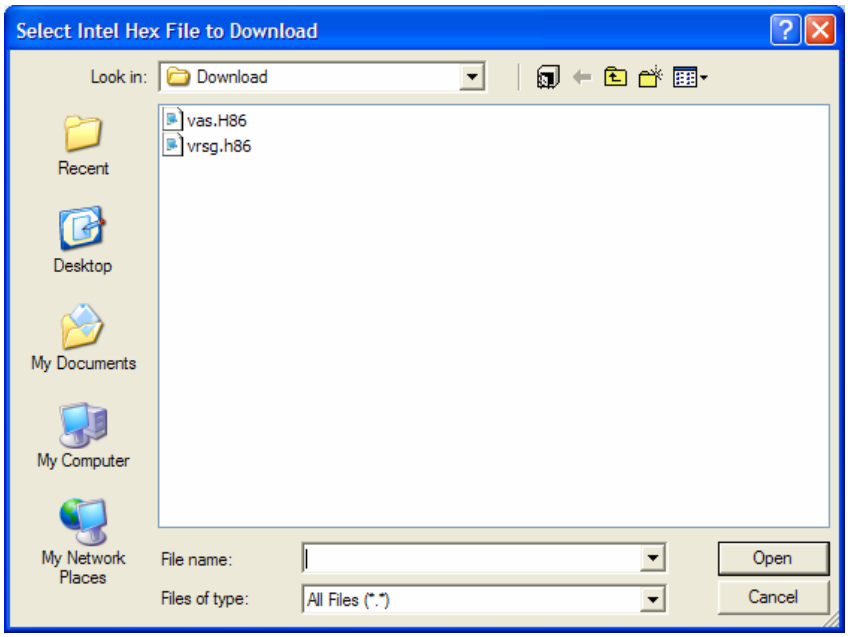
- All PDA's should be encased in a ruggedised cover to protect them from both damage and the effects caused by the environment they are used in.

6.6.6 Ensure that the appropriate Configuration Data file (VRSG.H86) and Application Firmware file (VAS.H86) for download reside within the C:\Products\Graphos\Download> directory on your laptop / PDA.

6.6.7 Execute the Graphos Download Program, the following main menu window will appear on screen.

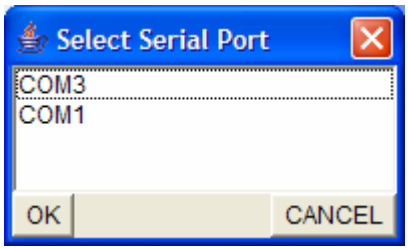


6.6.8 On clicking the **"Download"** button a file dialog box with the heading ***'Select Intel Hex File to Download'*** will appear, you need to make sure you are in the <Products\Graphos\Download> directory that was created in section **2.1**, above.



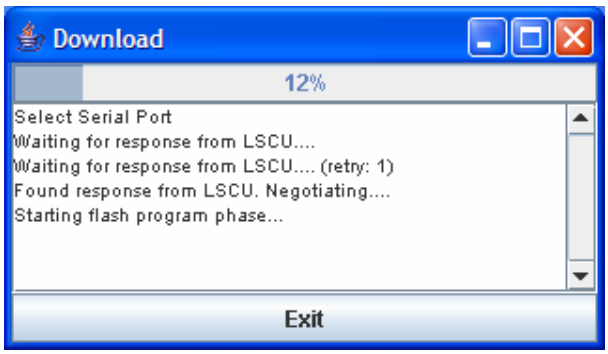
Highlight the required VRSG.H86 (Configuration Data) or VAS.H86 (Application Firmware) Intel Hex file for download and click **"Open"**.
(Refer to Step **2.4.1** for file download requirements).

6.6.9 A dialog box will now appear asking you to ***'Select Serial Port'***.

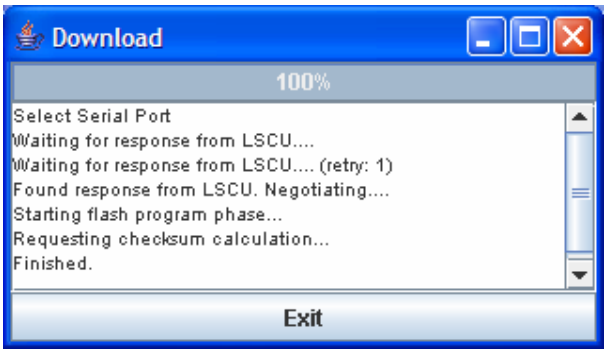


Select the required COM Serial Port from the drop down list and click **"OK"**.

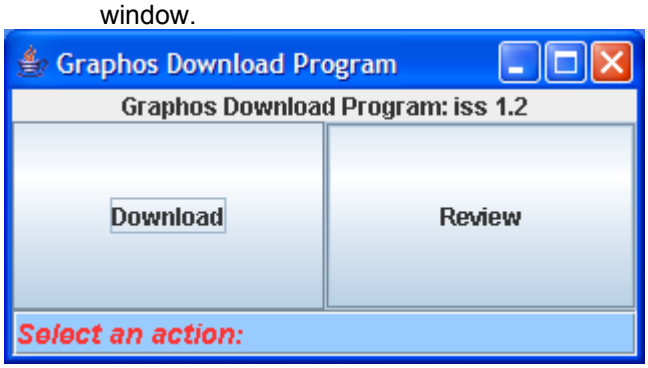
The download process will now proceed and the ***'Download'*** dialog box will appear. A progress bar gives a visual indication of the percentage of download that has been completed.



On completion, the ***'Download'*** dialog box will appear as follows:



The selected file has now been successfully downloaded. Clicking ***'Exit'*** will return to the main menu window.



6.6.10 You may now, if required:

a) Click ***'Download'*** again to download another file, if required? (Refer to Step **2.4.1** for file download requirements).
b) Click the ***'X'*** button to exit and close the program when finished. (Refer to Step **2.4.1** for file download requirements).

6.6.11 Once the required download(s) have been completed and no reviews are required, close down the program, remove the Download link and disconnect the interface cable between the Laptop / PDA and the LSCU.

6.6.12 Press the reset button on the LSCU or cycle the power off then back on.
Note: This step is very important as the new Configuration Data and/or Application Firmware will not be activated until the action is taken.

Graphos **configuration plug settings**

NOTE: Any timmings set by this

Plug side 1

Ident.	Default	Description
R1	1	**Sign operation mode**
R0	1	R1 R0 Status 1 1 Normal operation 1 0 Test mode (ignores fast vehicle detections) 0 1 Invalid 0 0 Test mode (acts on fast vehicle detections)
DIA	1	**Diagnostic port activated** 1 = COM2 in diagnostic mode 0 = COM2 set for communications mode
FP4	0	**LED failure detect (only works in test mode)** 1 = Ignore LED string failure 0 = Detect LED string failure
FP3	0	**Activation time in seconds**
FP2	1	FP3 FP2 FP1 FP0 Status
FP1	0	0 0 0 0 15s
FP0	1	0 0 0 1 14s 0 0 1 0 13 s 0 0 1 1 12 s 0 1 0 0 11 s 0 1 0 1 10 s 0 1 1 0 9 s 0 1 1 1 8 s 1 0 0 0 7 s 1 0 0 1 6 s 1 0 1 0 5 s 1 0 1 1 4 s 1 1 0 0 3 s 1 1 0 1 2 s 1 1 1 0 ``1 s 1 1 1 1 Invalid

NOTE:- Gemini if fitted can override timings / settings on this plug dependent upon the configuration loaded into the Gemini unit. So if you have a Gemini fitted and are not getting the settings you expect from this plug, please check the Gemini Configuration

Plug side 2

Ident.	Default	Description
Ma/sla	0	**Master Slave Mode** 1 = Slave 0 = Master
Rem/Aut	1	**Independent Mode** 1 = Vehicle activation detector directly connected 0 = Vehicle activation trigger received from Gemini
A0	1	**Sign address**
A1	1	A3 A2 A1 A0 Status
A2	1	1 1 1 1 Master Address 230, Slave 01
A3	1	1 1 1 0 Master Address 231, Slave 02 1 1 0 1 Master Address 232, Slave 03 . . . 0 0 0 0 Master Address 245, Slave 16
Bd0	1	**SITOS comms rate**
Bd1	1	**NOT USED FOR** GRAPHOS **APPLICATION** Bd1 Bd0 Status 1 1 COM 1 = 9600 bps 1 0 COM 1 = 38400 bps 0 1 COM 1 = 1200 bps 0 0 Invalid

0 = track cut, 1 = track intact

Example Plug settings:

Test Mode

R1	R0	DIA	FP4	FP3	FP2	FP1	FP0
1	0	1	0	0	1	0	1

MA	REM	A0	A1	A2	A3	BD0	BD1
0	1	1	1	1	1	1	1

Default Mode

R1	R0	DIA	FP4	FP3	FP2	FP1	FP0
1	1	1	1	1	1	0	1

MA	REM	A0	A1	A2	A3	BD0	BD1
0	1	1	1	1	1	1	1

6.7 GRAPHOS GEMINI CPU CONFIGURATION

All Gemini CPU configuration is performed from the in-station using RMS software. Refer to the RMS help file for information on how to do this.

7 GRAPHOS GEMINI HANDSET COMMANDS

Code	Index1	Index2	Data range	Comments	Access level
CNT	0 to 5	-	-	Key: 0 = loss of communications 1 = loss of modified config. 2 = no triggering at Master 3 = no triggering at Slave1 4 = no triggering at Slave2 5 = no triggering at Slave3	Needs Maintenance access code plus ETL=233 to be entered
ENG	72 to 75	0 to 40 or 0 to 16	-	Conditioning settings	Needs Maintenance access code plus ETL=233 to be entered
FLG	-	-	-	Fault log with time stamp	Read-Only
FLT	-	-	-	Displays current faults: FLT: !GRF <fault data> See note 1 below	Read-Only
GFR	-	-	-	Master control board flash rate	Read-Only
GIP	0 to 3	-	-	X4 inputs (last 4 bits) from: 0 = Master Sign 1 = Slave 1 2 = Slave 2 3 = Slave 3	Read-Only At present values will be always zero
GMD	-	-	-	Graphical Sign Mode 0 = Graphos Facility Disabled 1 = Init Phase Started 2 = Awaiting response from Master Sign 3 = Awaiting completion of Init Phase 4 = Normal Operation	Read-Only
GSP	0 to 3	-	-	View pictures set	Read-Only
GTM	0 to 3	-	-	Transmission msg data	Read-Only
LED	0 to 3	0 to 31	0 to 0xFF 0 means no string failures on that port	Status of the led strings: Index1: 0 - Master Sign 1 - Slave1 Sign, etc. Index2 : 0 - LDB1 port1 1 - LDB1 port2 2 - LDB1 port3 3 - LDB1 port4 4 - LDB2 port1 5 - LDB2 port2 …… 30 - LDB8 port3 31 - LDB8 port4 Note: a bit set to '1' means a faulty string	Read-Only
LMD	-	-	-	Master Control board Mode 0 = Mode Unknown 1 = Gemini Controlling Cluster 2 = Gemini Monitoring Cluster	Read-Only
LSO	0 to 3	-	0 to 100	Luminance setting (%)	Read-Only
SGM	0 to 4	-	0 to 4 0 means off	Set Aspect/Graphic Symbol Index1: 0 = all signs 1 = Sign 1 etc Data: 0 = blank 1 = picture 1 etc	Needs maintenance access code to be entered

Note 1: There are 3 bytes of fault data associated with Graphos failures.

The first byte indicates the sign number, i.e. 0 for failures reported by Gemini, 1 for failures reported by the Master, 2 for failures reported by Slave 1, etc.

The second byte gives the Fault Number:

Gemini failures

1 - Gemini Unit is unable to communicate with the Master Sign
2 - Master Sign has replied indicating the last set message was invalid
10 - Master Sign has replied with information from additional signs

LSCU failures

3 - LSCU radar has not triggered
4 - Voltage on LDB board is missing
5 - System error on LDB board
6 - Invalid picture number in last set message
7 - Ambient light sensor failure
8 - LED failure
9 - Incorrect picture being displayed
11 - Missing or defect LDB board

The third byte is normally zero.

However for the loss of comms failure (second byte = 1); the third byte is set to the Sign number, i.e. 1 = loss between the Gemini and the Master LSCU;
2 = loss between the Master LSCU and Slave 1 LSCU,
3 = loss between the Master LSCU and Slave 2 LSCU, etc.

8 GRAPHOS GEMINI FAULT CODES

For the full list of fault codes and fault diagnosis details see the Graphos Fault Finding and Troubleshooting Guide (667/HE/31200/000).
Note for some faults, reference must be made to Engineering in Poole.

9 SPARES LIST

412/4/30007/000	Filter for air vents
998/4/88326/001	20 core data cable
998/4/70468/002	4 core armoured cable
998/4/70468/004	8 core armoured cable
667/1/31285/000	Helios brackets kit
667/1/31287/001	large bracket
667/1/31259/000	ALS
S24777-A3340-UK	LSCU Control board
G32905-N110-U22	Configuration plug
C24734-A11-C108	Config Plug securing tie
S24777-A3380-A21	LED Driver Board
605/4/08681/002	PSU (+48 V)
667/7/31218/001	LED String White
667/7/31218/002	LED String Red
667/7/31218/003	LED String Yellow
667/1/26608/001	Gemini CPU card
667/7/30613/000	Gemini PSU (13.8 V)
656/4/21380/001	Gemini GSM Modem
667/7/26582/004	Gemini PSTN Modem
640/4/90014/000	Gemini GSM Antenna
418/4/42314/010	Gemini Lead Acid Battery
667/7/31289/000	168 base isolator
667/1/31252/000	219 base MDU

10 ADJUSTMENT AND ACCESS

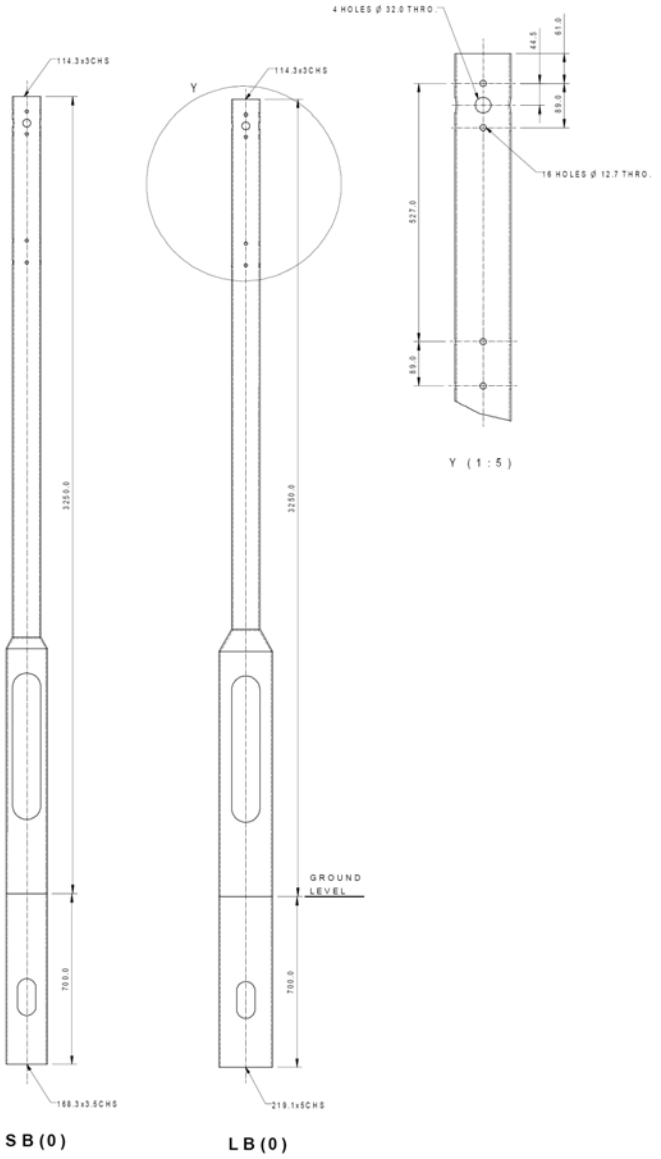
The spanners or sockets required for Graphos bracket adjustments are 13mm and 17mm A/F.
The Allen Keys required for Graphos are 10mm A/F for adjusting the Helios Brackets, and 4mm A/F for the front door. To access the doors on the belled poles a triangular key is required (STC part number 654/4/01084/000).

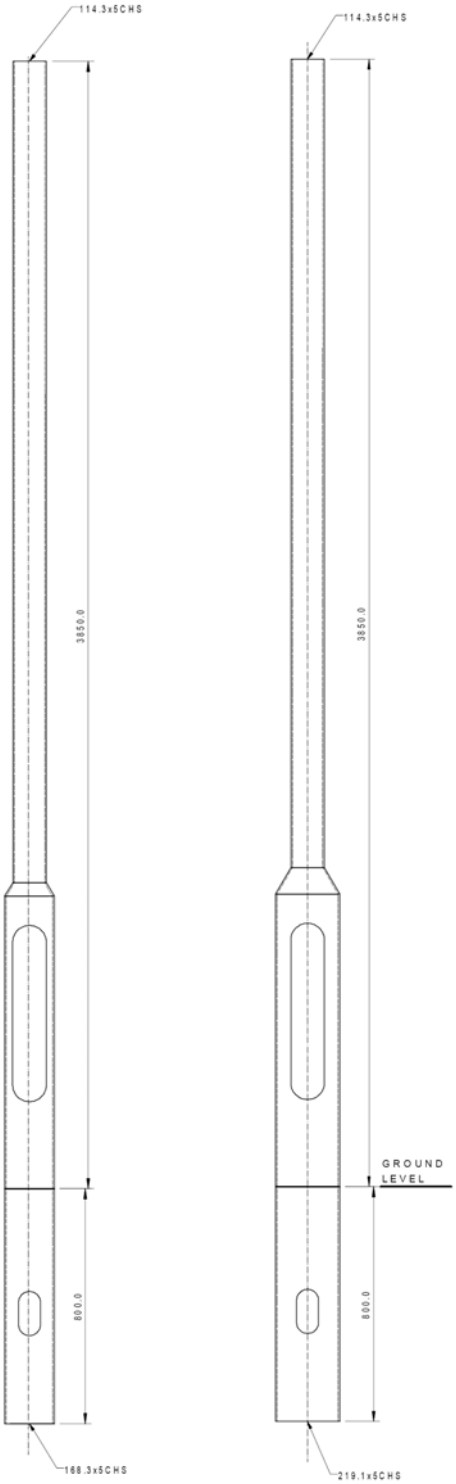
11 GRAPHOS MOUNTING POLES

Pole Type	Bell size	Siemens part number	Pole length (mm)	Maximum sign size* (mm)
SB(0)	Standard (168 mm)	667/2/31201/0YZ	3950	800 x 900 x 120
SB(1)	Standard (168 mm)	667/2/31201/1YZ	4650	800 x 1400 x120
SB(2)	Standard (168 mm)	667/2/31201/2YZ	5250	1000 x 1800 x 150
SB(3)	Standard (168 mm)	667/2/31201/3YZ	7450	1200 x 2000 x 200
LB(0)	Large (219 mm)	667/2/31202/0YZ	3950	800 x 900 x 120
LB(1)	Large (219 mm)	667/2/31202/1YZ	4650	800 x 1400 x120
LB(2)	Large (219 mm)	667/2/31202/2YZ	5250	1000 x 1800 x 150
LB(3)	Large (219 mm)	667/2/31202/3YZ	7450	1200 x 2000 x 200

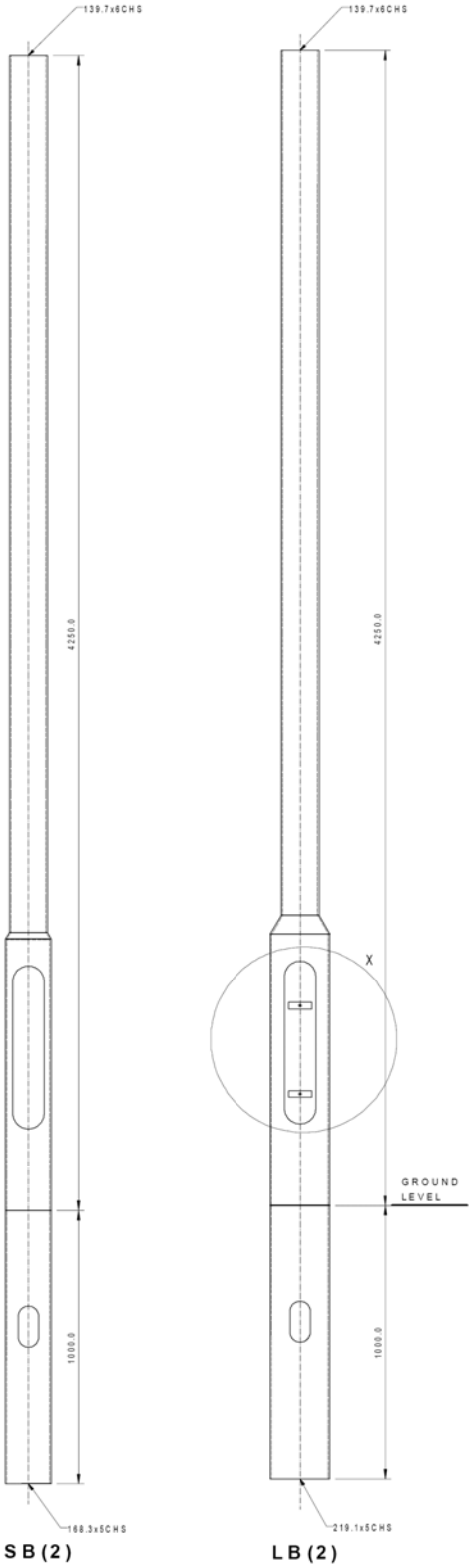
* width x height x depth

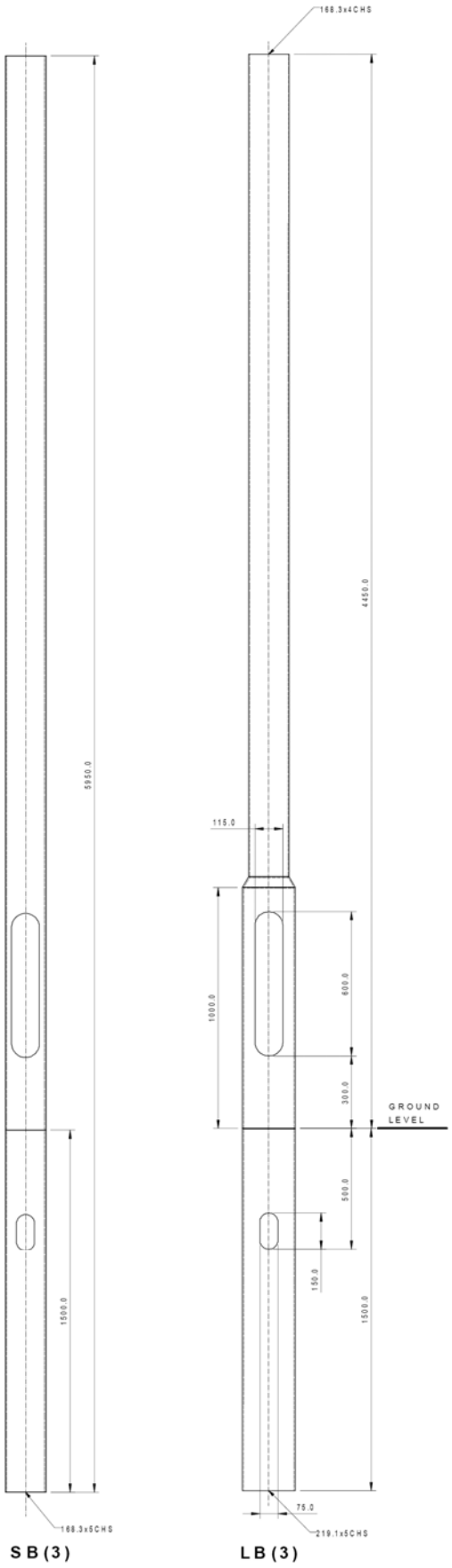
Last two digits of part number (YZ) represent further Pole options.
Y = 0, with cable slot
Y = 1, without cable slot
Z = 0, natural finish, not painted
Z = 1, painted aircraft grey BS381C No. 693 (RAL7037)




114.3x5CHS
3850.0
800.0
168.3x5CHS
114.3x5CHS
3850.0
GROUND
LEVEL
800.0
219.1x5CHS

SB(1) LB(1)


139.7x6CHS
4250.0
1000.0
168.3x5CHS
SB(2)
139.7x6CHS
4250.0
X
GROUND
LEVEL
1000.0
219.1x5CHS
LB(2)


168.3x4CHS
4450.0
5950.0
115.0
1000.0
600.0
300.0
GROUND
LEVEL
500.0
150.0
1500.0
1500.0
75.0
168.3x5CHS
219.1x5CHS
SB(3)
LB(3)

12 FOUNDATION SPECIFICATIONS

12.1 GENERAL POLE INSTALLATION DETAIL DRAWING F01

NOTES

1. BEFORE INSTALLING ANY POLE MAKE SURE IT IS THE CORRECT ONE FOR THE SIGN. THIS MAY BE DONE BY REFERING TO FIGURES BELOW, AND CHECKING THE POLE DIAMETER MATCHES THAT REQUIRED FOR THE SIGN SIZE.

2. ALL MATERIALS SHALL BE HANDLED USING SUITABLE MECHANICAL EQUIPMENT OR SUFFICIENT MANPOWER FOR THE WEIGHT OF THE ITEM BEING HANDLED.

3. ALL CONCRETE TO BE STANDARDISED PRESCRIBED CONCRETE 'GEN 1' TO BS 8500.

4. EXCAVATION TO BE CARRIED OUT CAREFULLY WITH REGARD TO THE POSSIBILITY OF BURIED SERVICES.

5. ALL CONCRETE SHALL ALL BE LAID IMMEDIATELY AFTER FORMATION HAS BEEN EXPOSED AND APPROVED – ANY DELAY SHALL RESULT IN ANY DETERIORATED MATERIAL BEING REMOVED AND VOIDS FILLED WITH CONCRETE.

6. WHERE CONCRETE SURROUND REQUIREMENT IS SHOWN AS 'NONE', VOID AROUND ROOT TO BE BACKFILLED IN ACCORDANCE WITH PD 6547 (CONCRETE IS ACCEPTABLE).

7. THE POLE SHOULD BE INSTALLED SUCH THAT THE DOOR FACES AWAY FROM TRAFFIC. THIS ENSURES THAT WHEN ANY ENGNIEER IS WORKING ON IT THEY ARE LOOKING TOWARDS THE TRAFFIC, AND SHOULD A VEHICLE HIT THE POLE THE POLE SHOULD COLLAPSE AWAY FROM THE VEHICLE AS THE DOOR IS THE WEAKEST PART.

8. THE CABLE FROM THE MDU TO MUST BE INSTALLED SUCH THAT THERE IS A LOOP AT THE BOTTOM THAT GOES BELOW ITS TERMINATION INTO THE MDU. SUCH THAT ANY DRIPS THAT MAY RUN DOWN THE CABLE CAN NOT RUN INTO THE TERMINATION

9. SOIL QUALITY IS DEFINED IN PD 6547 AS FOLLOWS:

   POOR : SOFT CLAY, CLAY LOAM, POORLY COMPACTED SAND, CLAYS CONTAINING A LARGE AMOUNT OF SILT & VEGETABLE MATTER, AND MADE-UP GROUND.POOR SOILS ARE NORMALLY WET AND HAVE POOR DRAINAGE.

   AVERAGE : COMPACT FINE SAND, MEDIUM CLAY, COMPACT WELL DRAINED SANDY LOAM, LOOSE COARSE SAND AND GRAVEL.

   AVERAGE SOILS DRAIN SUFFICIENTLY WELL THAT WATER DOES NOT STAND ON THE SURFACE.

   GOOD : COMPACT WELL GRADED SAND AND GRAVEL, HARD CLAY, WELL GRADED FINE AND COARSE SAND, DECOMPOSED GRANITE ROCK AND SOIL. GOOD SOILS DRAIN WELL.

NOTES – POST

1. ALL STEEL GRADE S355J2H TO BE EN 10210 OR 10219.

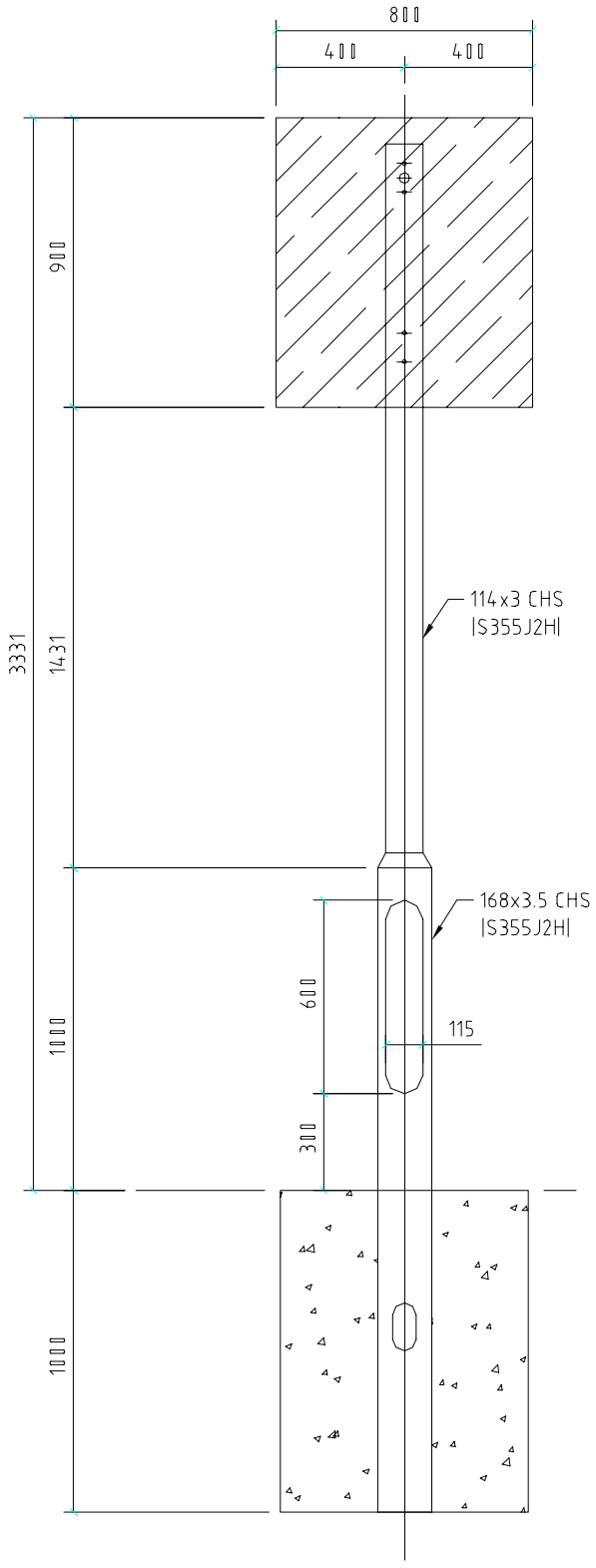
2. CONNECTION OF SIGN TO POST, AND DESIGN OF SIGN, BY OTHERS.

3. JOINT BETWEEN SHAFT AND BASE SECTIONS TO DEVELOP FULL STRENGTH OF SHAFT ABOVE (DESIGN BY POST MANUFACTURER).

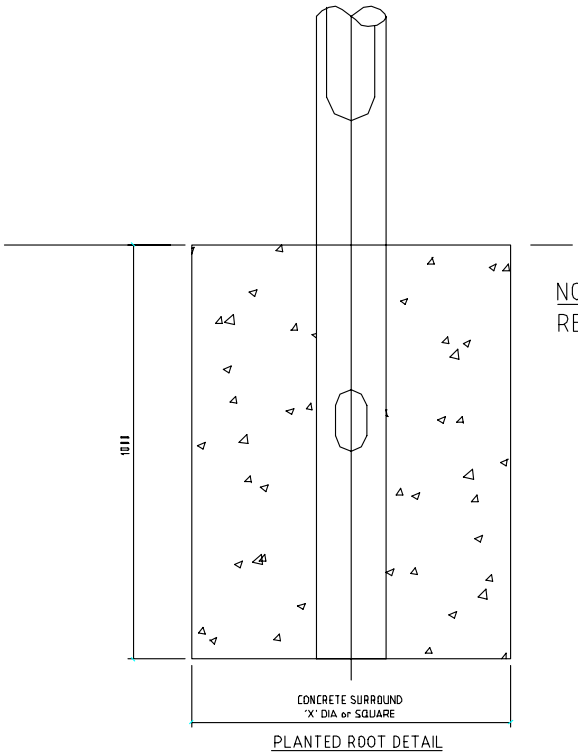
4. POST IS DESIGNED TO EN 40 & PD 6547 USING THE FOLLOWING PARAMETERS :
   LOCATION - ANY UK EXCEPT SHETLAND
   ALTITUDE - NOT MORE THAN 250m
   MEAN RETURN PERIOD - 25 YEARS
   TOPOGRAPHY FACTOR - 1.0
   TERRAIN CATEGORY - I
   RATIONALISED WIND FACTOR - EXTRA HEAVY
   PARTIAL LOAD FACTORS - CLASS A
   PARTIAL MATERIAL FACTOR - 1.15
   DEFLECTION CLASS - 1
   POST & SIGN PROPERTIES - SEE DRAWINGS & CALCULATIONS
   POSTS HAVE ALSO BEEN CHECKED TO BS 873.

12.2 800 X 900 X 120

12.2.1 SMALL BELLED



COLUMN TYPE : SB(0)

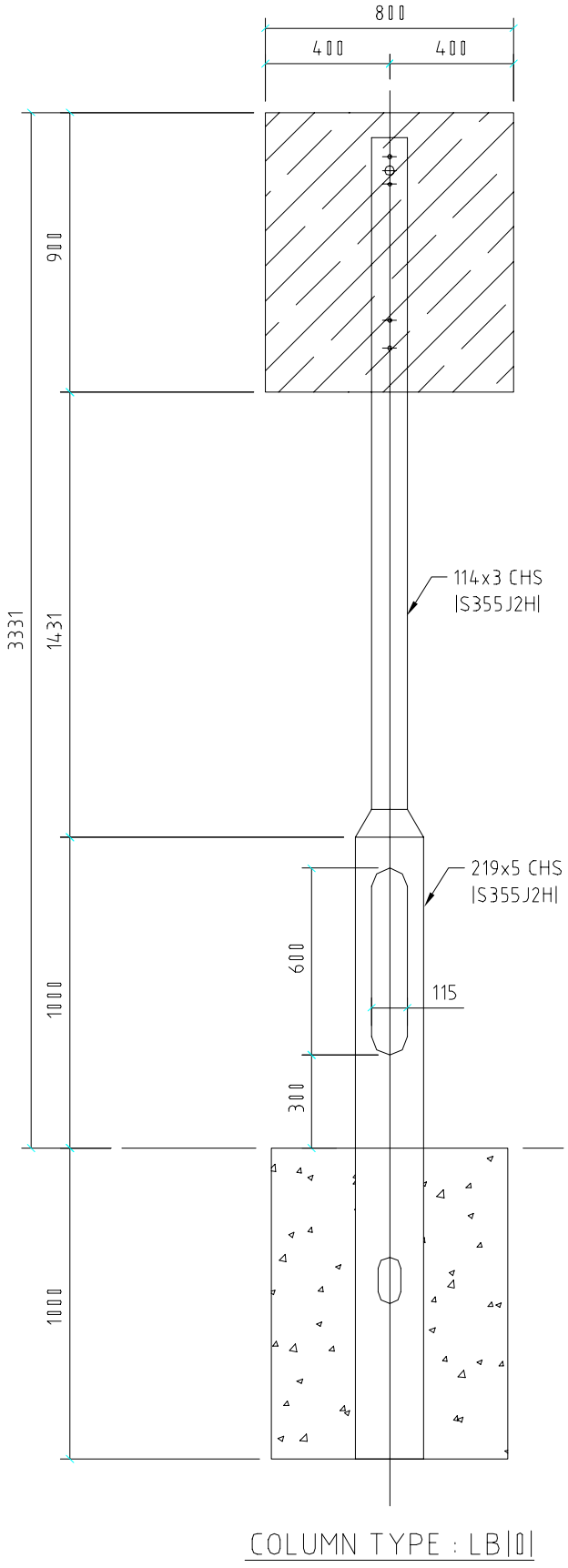


PLANTED ROOT DETAIL

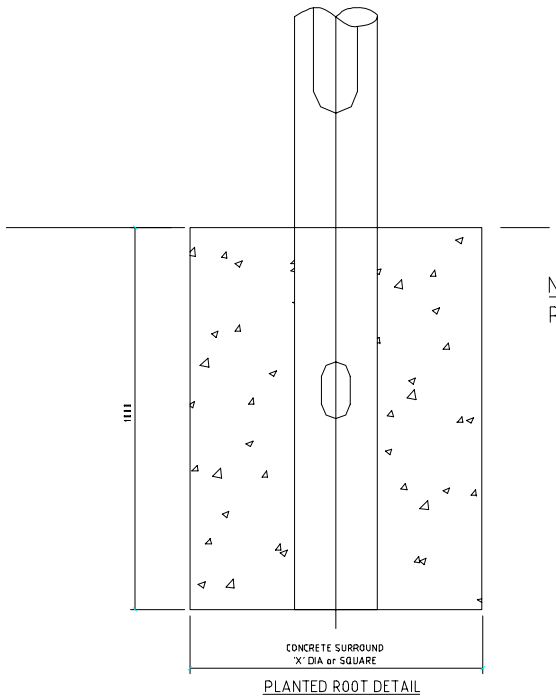
NOTES
REFER TO DRAWING

SOIL QUALITY	DIM 'X' (mm)
POOR	525
AVERAGE	300
GOOD	200

12.2.2 LARGE BELLED



COLUMN TYPE : LB(0)



PLANTED ROOT DETAIL

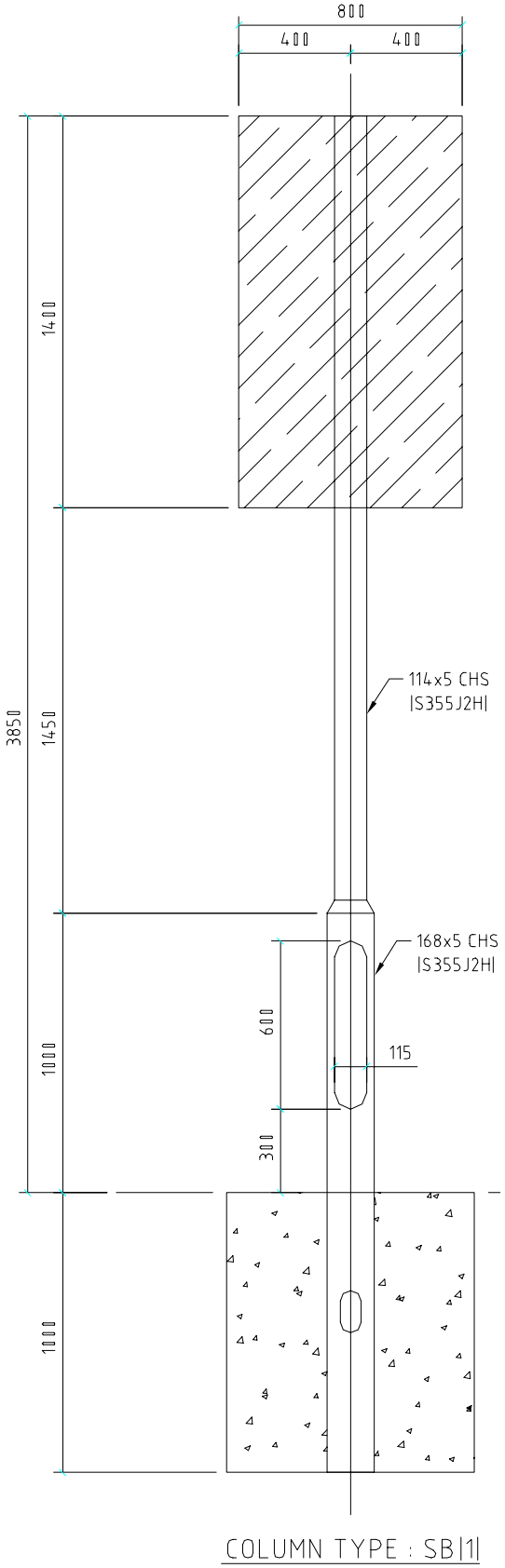
NOTES

REFER TO DRAWING N

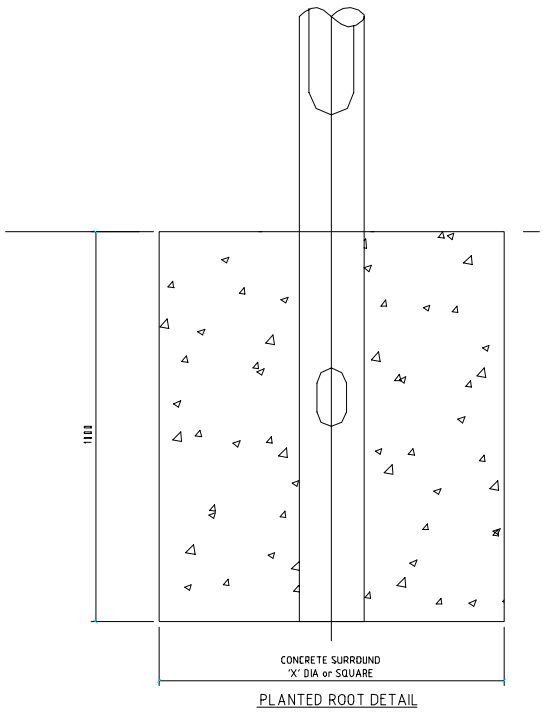
SOIL QUALITY	DIM 'X' (mm)
POOR	525
AVERAGE	300
GOOD	NONE

12.3 800 X 1400 X120

12.3.1 SMALL BELLED



COLUMN TYPE : SB(1)

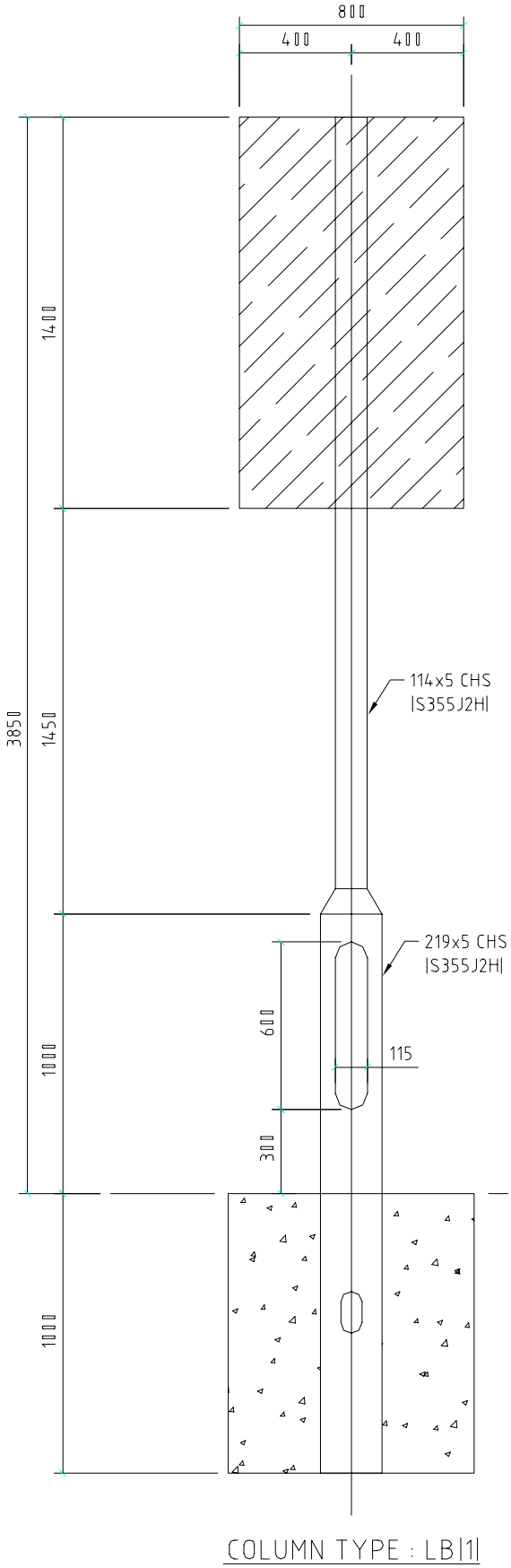


PLANTED ROOT DETAIL

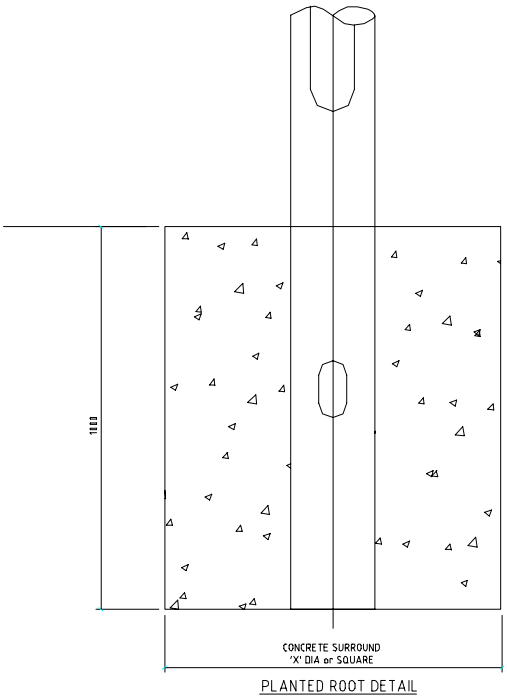
NOTES
REFER TO DRAWING No. F0

SOIL QUALITY	DIM 'X' (mm)
POOR	825
AVERAGE	500
GOOD	300

12.3.2 LARGE BELLED



COLUMN TYPE : LB(1)



PLANTED ROOT DETAIL

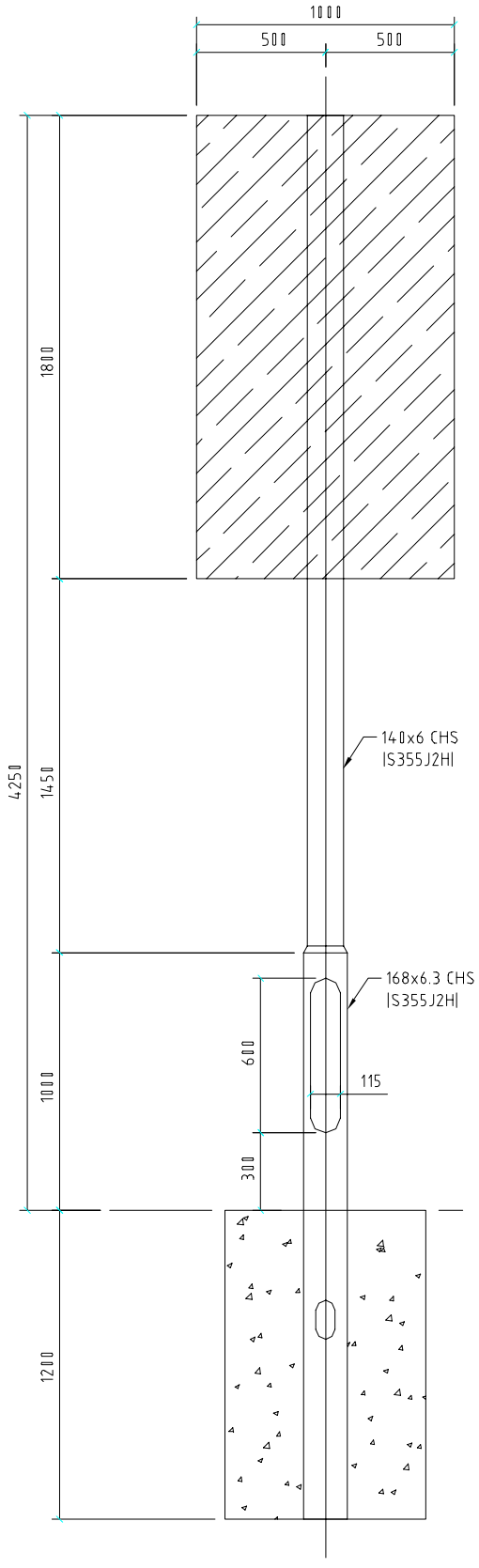
NOTES

REFER TO DRAWING No. F01

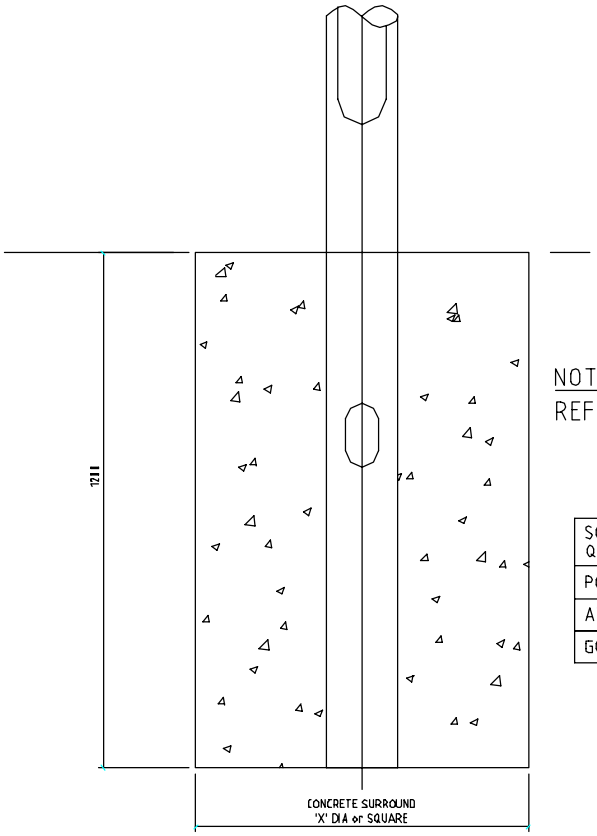
SOIL QUALITY	DIM 'X' (mm)
POOR	825
AVERAGE	500
GOOD	300

12.4 1000 X 1800 X 150

12.4.1 SMALL BELLED



COLUMN TYPE : SB(2)

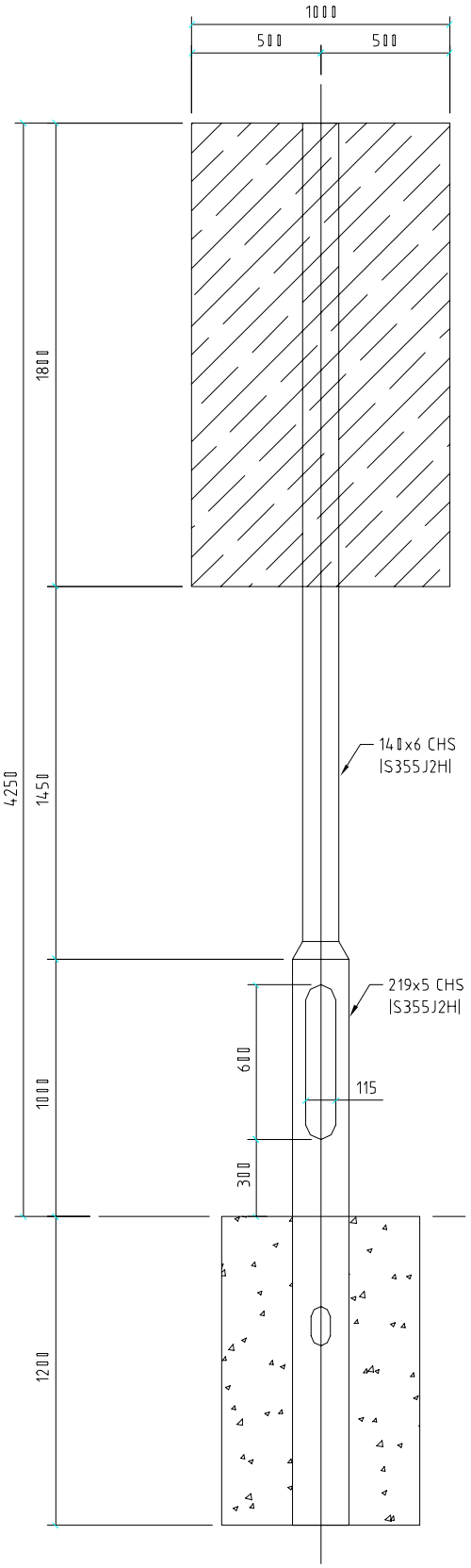


PLANTED ROOT DETAIL

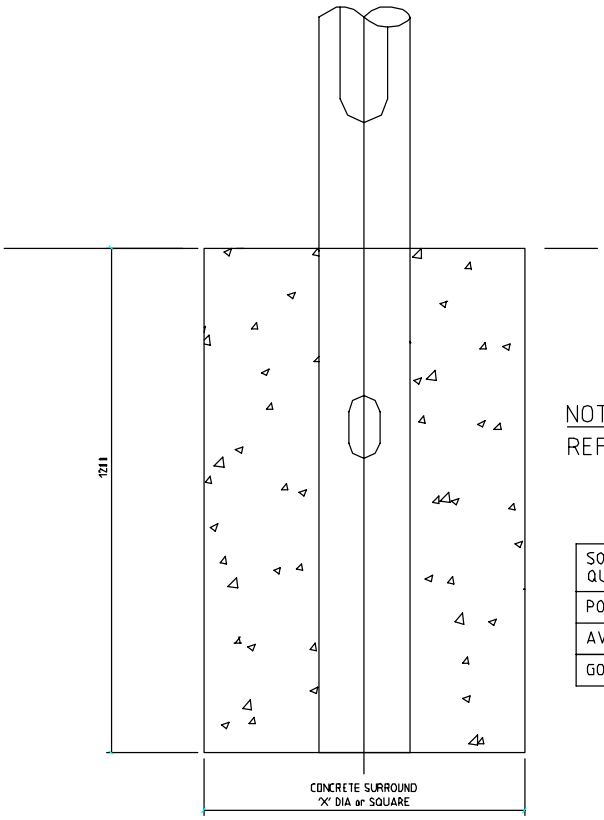
NOTES
REFER TO DRAWING No. F01

SOIL QUALITY	DIM 'X' (mm)
POOR	825
AVERAGE	500
GOOD	300

12.4.2 LARGE BELLED



COLUMN TYPE : LB(2)



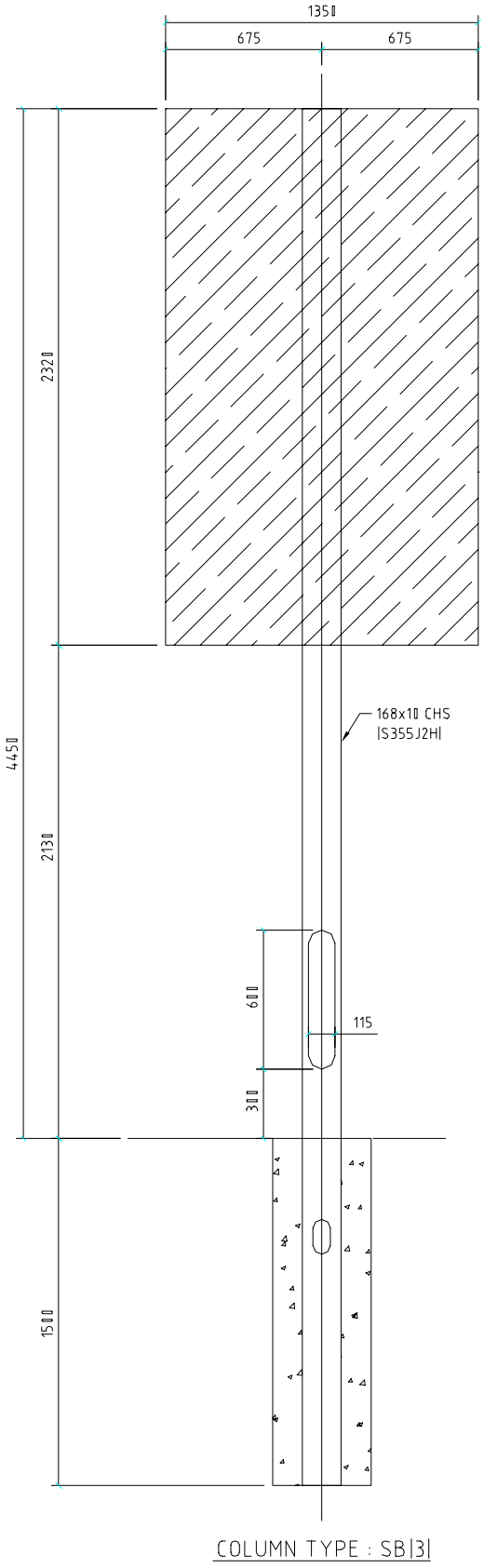
PLANTED ROOT DETAIL

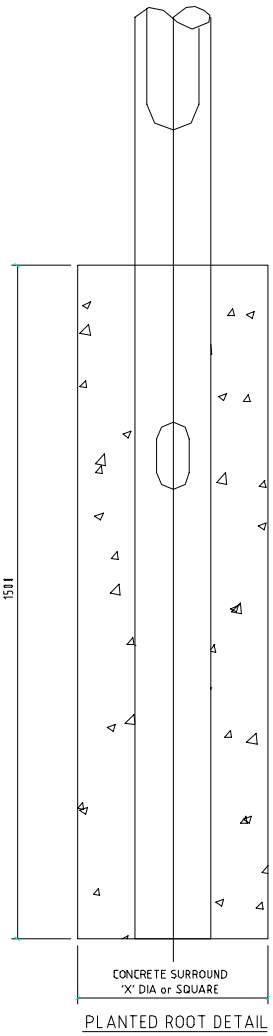
NOTES
REFER TO DRAWING No. F01

SOIL QUALITY	DIM 'X' (mm)
POOR	800
AVERAGE	500
GOOD	300

12.5 1200 X 2000 X 200 STANDARD (STRESSED TO 1350 X 2320)

12.5.1 SMALL BELLED

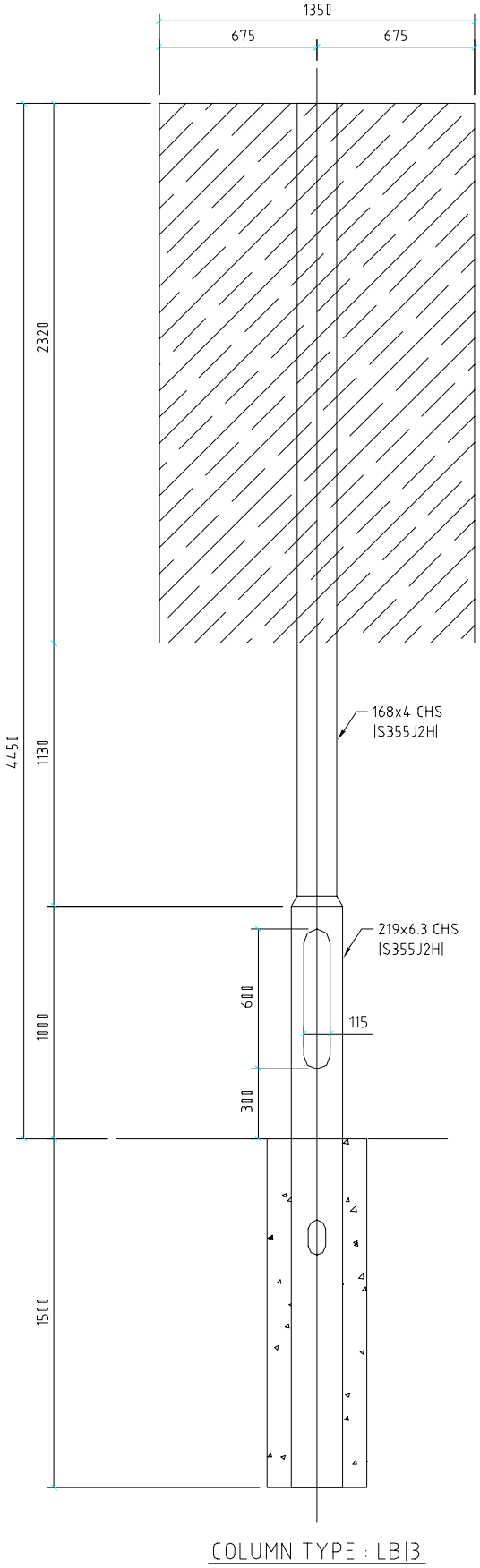




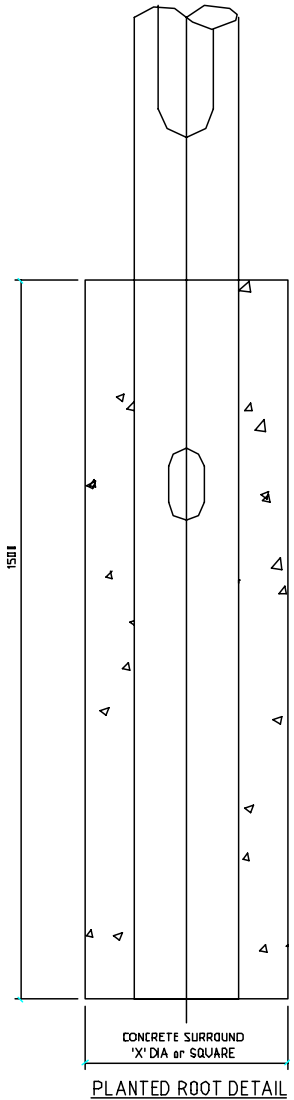
NOTES
REFER TO DRAWING No. F01

SOIL QUALITY	DIM 'X' (mm)
POOR	725
AVERAGE	425
GOOD	275

12.5.2 LARGE BELLED



COLUMN TYPE : LB(3)



PLANTED ROOT DETAIL

NOTES
REFER TO DRAWING No. F01

SOIL QUALITY	DIM 'X' (mm)
POOR	725
AVERAGE	425
GOOD	275

13 INSTALLATION GENERAL

The Pole should be installed in accordance with section 12 above. The following handbooks should also be referenced for specific products that may be involved. Poles and Ducts, Cabling, Loop Detectors, above Ground Detectors and Gemini. These are all available via STC on the Internet and on CDs when requested.

Handbook ST4R Loop Detector	667/HB/27663/000
Loop Detector and Cable Terminations - Installation and Commissioning	667/HE/20663/000
Helios General Handbook	667/HB/30000/000
Installation and Commissioning Handbook 5 - Above Ground Detectors	667/HE/20665/000
Installation and Commissioning Handbook 2 - Signals and Poles	667/HE/20662/000

The Smaller range of signs uses Helios signal brackets and therefore for details of installation and adjustment the Hellios handbook can be referenced, when necessary.

For the larger range of signs a Graphos specific set of brackets are used which use studding to provide the tilt and angular adjustment, an assembly drawing of which should be shipped with the sign.

Refer to section 5 for the different types and modes of operation, as these affect the subsequent different types of inter connection between signs. Refer to section 4 for details of termination points.

14 COMMISIONING

Each sign installation, must first be electrically tested, reference should be made to the Installation testing handbook noted below. The sign can be considered as a controller, with the sign casing being the outercase, with control equipment inside. The cut out and isolator in the bottom of the pole can be considered as the master switch. With the pole considered as any other pole. Thus the tests in the handbook referencing the various part of the controller can be related to those of the sign, and the results recorded accordingly.

For reference when testing Earth loop impedance the fuses used in the belled poles are as follows.

Small Belled Poles BS88 6 Amp Max Earth Loop Impedance Value 10.575 Ohms
Large Belled Poles BS 1361 5 Amp Max Earth Loop Impedance Value 12.825 Ohms

Installation and Commissioning Handbook - Installation Testing (General)	667/HE/20664/000

To commission any detectors used in the installation, AGD or Loop, reference should be made to the specific detectors handbook, see installation section above. If a Gemini is used in the sign then the Traffic outstation handbook should be referenced for its commissioning.

Once the above items have been commissioned the sign as a whole can be commissioned the following tests will prove the operation of the signs.

14.1 SIGN OPERATION PROVING TESTS

14.1.1 BASIC SIGN

With the master switch in bottom of the pole switched on, switch the sign off (secondary switch within the sign itself).

Verify that there is no power applied to the LSCU and LDBs – all status LEDs are off.

Remove the configuration plug from the LSCU board and store it in a safe place.

Replace the configuration plug with the “TEST” configuration plug.

Switch the internal mains switch on.

Verify that the eight LEDs on each LDB are in the off state i.e. not indicating LED string errors.

Where the sign configuration contains only one aspect, ensure that the sign display cycles such that all of the LEDs illuminate and then extinguish. The cycle should repeat continuously.

Where the sign configuration contains more than one aspect, ensure that the sign display cycles through each aspect illuminating and extinguishing all of the associated LEDs. The cycle should repeat continuously.

Where beacons are fitted, check that they flash in pairs top first then bottom.

Verify that the LSCU seven-segment display shows ‘00’ when the LED strings are off. Check that the seven-segment display shows 01 through 0x where x is the number of separate aspects configured for the sign.

Check the sign dimming operation: Temporarily cover the light sensor, located at the top of the sign housing. Note that the LEDs grow progressively dimmer. When the LEDs have become static, i.e. they are no longer growing dimmer, uncover the light sensor and observe the progressive brightening of the LEDs.

Switch the sign off using the internal mains switch.

Retrieve the configuration plug that was originally removed from the sign. Remove the “TEST” configuration plug and replace it with the configuration plug. NB The sign should be delivered with a correctly modified configuration plug (i.e. track cut as indicated on the plug configuration sheet enclosed in the sign. However if there is any question over the signs operation in respect of features that can be changed via this plug (see section 6.7), or if a new / revised plug is to be fitted. Reference should be made to the plug configuration sheet previously mentioned and track cuts checked.

Switch the internal mains switch on.

Verify that the LSCU seven segment display shows “00” and that the LEDs on the LDBs are in their off state.

Activate the vehicle activation input either by activating the detector itself, or by applying an appropriate shorting link across the detector input.

Verify that the sign illuminates for the period of time specified by the configuration sheet. (NB When flashers are fitted the top set should always illuminate first when the sign activates, and this can be checked).

Verify that the LSCU seven-segment display shows “00” and that the fault LEDs on the LDBs are in their off state.

Remove any temporary links made on the sign.

Close the sign(s) up. The sign is now ready for normal operation. If possible the final sign operational test (noted at the end of this section 14.2) should be performed.

14.1.2 MASTER / SLAVE SYSTEM TEST (ASSUMING GEMINI CONFIGURATION FACTORY LOADED)

(NB The following are Generic tests for When a Gemini is fitted. It should be noted that special conditioning can be added to the Gemini to create very specific sign operation characteristics, reference should be made to any special conditioning to check if any additional conditions need to be tested.)

Ensure that the master and slave interconnection wiring is complete.

Ensure that the appropriate termination links are fitted.
On a Master LSCU Fit links between pins 1 and 2, 3 and 4, 5 and 6 of X103 .
On a Slave the above links should not be fitted.
On the last slave in a chain Fit a link between pins 1 and 2 of X102 on the LSCU..

Switch the master switch in the bottom of the pole on, ensure the internal mains switch for each sign is in the off position.

Verify for each sign that there is no power applied to the LSCU(s) and that the status LED's on the LDBs are off.

Ensure that the configured "Sign Configuration Plug" is fitted within both / all signs.

Connect the handset / P.C. to the handset port on the Gemini fitted within the master sign, (the 25 way d-type connector SK2 on the Gemini unit).

Switch the internal mains switch in each sign on.

Establish communication with Gemini by repeatedly entering CR.

Issue the PME=249 command to enable handset commands on the Gemini.

Issue GMD wait for 15 seconds, check that the response is GMD:4, and has not changed. If the response is 1 or 2 then there is a problem between the Gemini and the master LSCU. If the response is 3 then one or more slave signs are not responding. (You may also re send Gemini enabling command Enable Graphos communication by issuing LDV=10, although this should have been done in the factory).

Issue the FLT command. Check the response, if there are faults (which may be historic and are now cleared) ie. If the response is not, FLT:NO FAULTS. Then these will need to be cleared from the RMS Instation.

Issue the SGM0=1 command to set all signs. Ensure that the master and all slaves illuminate with the default aspect. (Note If the Gemini is running time of day sign operation this first command may immediately get overridden, re send it and the Gemini will switch to handset commands, and should be restored using SGM0=255 at the end of commissioning).

Issue the SGM0=0 command to clear all signs. Ensure that the master and all slaves extinguish.

Repeat the above two steps for each configured aspect by issuing SGM0=x where x is the aspect number. (NB If an invalid aspect is requested the seven segment display will show A.5. This will clear when a valid aspect is requested or the 15 second timeout expires).

(NB If after issuing any SGM0 command you wish to try and set individual signs using other SGM commands i.e. SGM1 for master SGM2 for first slave etc. Then you must first issue SGM0=255 command,

Restore Gemini to normal operation by issuing the command SGM0=255

If the signs are required to operate at specific times of day, (noted in the Gemini Configuration), then using the TOD command (e.g. TOD=12:32:00) the sign faces displayed at different times of day can be checked. At the end ensure the TOD is set to current time.

Issue the FLT command. Check the response, if there are faults (which may be historic and are now cleared) ie. If the response is no,t FLT:NO FAULTS. Then these will need to be cleared from the RMS Instation.

Reset the LSCU by actuating the reset switch.

Close the sign(s) up. The sign is now ready for normal operation. If possible the final sign operational test (noted at the end of this section 14.2) should be performed.

14.1.3 MASTER / SLAVE SYSTEM TEST (ASSUMING BLANK GEMINI CONFIGURATION OR NEW GEMINI CONFIGURATION IS TO BE LOADED LATER)

The sign can be tested for basic operation with Gemini, with the outstation unit in a raw state (prior to the loading of any Gemini configuration from and RMS Instation, if required.). For example if the configuration is delayed for any reason and the customer is happy to re test when the configuration is available.

(NB The following are Generic tests for When a Gemini is fitted. It should be noted that special conditioning can be added to the Gemini to create very specific sign operation characteristics, reference should be made to any special conditioning to check if any additional conditions need to be tested.)

Ensure that the master and slave interconnection wiring is complete.

Ensure that the appropriate termination links are fitted.
On a Master LSCU Fit links between pins 1 and 2, 3 and 4, 5 and 6 of X103 .
On a Slave the above links should not be fitted.
On the last slave in a chain Fit a link between pins 1 and 2 of X102 on the LSCU..

Switch the master switch in the bottom of the pole on, ensure the internal mains switch for each sign is in the off position.

Verify for each sign that there is no power applied to the LSCU(s) and that the status LED’s on the LDBs are off.

Ensure that the configured “Sign Configuration Plug” is fitted within both / all signs.

Connect the handset / P.C. to the handset port on the Gemini fitted within the master sign, (the 25 way d-type connector SK2 on the Gemini unit).

Switch the internal mains switch in each sign on.

Establish communication with Gemini by repeatedly entering CR.

Issue the PME=249 command to enable handset commands on the Gemini.

Issue the INI=1 command to reset the Gemini (Note this will clear any existing configuration that has been downloaded)

Establish communication with Gemini by repeatedly entering CR.

Issue the PME=249 command to enable handset commands on the Gemini.

Enable the Gemini to communicate with Graphos by issuing LDV=10

Issue GMD wait for 15 seconds, check that the response is GMD:4, and has not changed. If the response is 1 or 2 then there is a problem between the Gemini and the master LSCU. If the response is 3 then one or more slave signs are not responding.

Issue the FLT command. Ensure that the response is FLT:NO FAULTS

Issue the SGM0=1 command to set all signs. Ensure that the master and all slaves illuminate with the default aspect.

Issue the SGM0=0 command to clear all signs. Ensure that the master and all slaves extinguish. (NB If an invalid aspect is requested the seven segment display will show A.5. This will clear when a valid aspect is requested or the 15 second timeout expires

Repeat the above two steps for each configured aspect by issuing SGM0=x where x is the aspect number.

(NB If after issuing any SGM0 command you wish to try and set individual signs using other SGM commands i.e. SGM1 for master SGM2 for first slave etc. Then you must first issue SGM0=255 command,

Restore Gemini to normal operation by issuing the command SGM0=255

Issue the FLT command. Ensure that the response is FLT:NO FAULTS.

Disable the Gemini to Graphos communications (until correct / required Gemini configuration is downloaded from the RMS Instation), by resetting the Gemini Issuing the INI=1 command.

Reset the LSCU by actuating the reset switch.

Activate the vehicle activation input either by activating the detector itself, or by applying an appropriate shorting link across the detector input.

Verify that the master sign illuminates for the period of time specified by the configuration sheet.

If there is a detector connected to any slave signs, activate the vehicle activation input on the slave either by activating the detector itself, or by applying an appropriate shorting link across the detector input.

Verify that the slave sign illuminates for the period of time specified by the configuration sheet.

14.1.4 INPUT TESTS (WHEN GEMINI FITTED)

Using a shorting link with one end connected to 0 volts Com (pin 6) of the detector input terminal block in the Master sign.

Issue the DIP 3 0 command.

The response should be -- DIP 3 0:00000000 indicating that no inputs are active.

Activate each of the inputs in turn (by applying short to 0 volts). Check that the appropriate bit changes in the response detailed at the handset.
e.g.
DIP 3 0:00000000
DIP 3 0:10000000
DIP 3 0:01000000
DIP 3 0:00100000
DIP 3 0:00010000
DIP 3 0:00001000
DIP 3 0:00000100
DIP 3 0:00000010
DIP 3 0:00000001

Close the sign(s) up. The sign is now ready for normal operation. If possible the final sign operational test (noted at the end of this section 14.2) should be performed.

14.2 FINAL OPERATIONAL TEST

THIS TESTING SHOULD ONLY BE ATTEMPTED, WHERE SPEED LIMITS ALLOW AND / OR LIVE TESTING HAS BEEN AGREED WITH THE LOCAL AUTHORITY AND PLOICE, AND IT IS SAFE TO DO SO (I.E. ROAD AND TRAFFIC CONDITIONS ALLOW)

As a final test of Vehicle activated signs, a vehicle can be driven through the activation zone at speeds above and below the activation speed threshold, to check that the sign(s) activate(s) when expected.
If the sign activation durations need to be adjusted, please refer to section 6.7 Graphos Gemini CPU configuration, if a Gemini is used, sign setting can be changed by downloading a new configuration from the RMS system, or locally using the handset commands that can be found in section 7 Graphos Gemini handset commands.

15 FAULT FINDING

Refer to the Graphos Fault Finding and Troubleshooting Guide (667/HE/31200/000)

The following error codes should however be referred directly to engineering at Poole as there are faults that require more in depth investigation that is possible by simply following the guide noted above.

Refer to Poole Engineering

0x04	0x70	0x72	0x73	0x74	0x76	0x78	0x7E	0x81	0x85
0x86	0x87	0x89	0x8A	0x8B	0x8D	0x8E	0x8F	0x91	0x97
0x99	0xA0	0xA1	0xA2	0xA7	0xAA	0xAC	0xAD	0xC3	0xC6
0xC7	0xCA	0xCE	0xD6	0xD7					

16 PERIODIC INSPECTION AND PREVENTATIVE MAINTENANCE

Graphos annual preventative maintenance

Sign exterior

- **Task 1** – Check that there is no overgrowing foliage blocking the sign fascia. There should be a clear area surrounding the sign of at least 1 metre.

Rectification - The foliage is to be cut back to the recommended clearance. This should not be carried out until the local authority has granted permission. Because given the location and topology of the site, there may be environmental issues, sensitivities, protective legislation, etc. that govern what work can be done when, and by whom. It may therefore be necessary to employ the services of a qualified tree surgeon or similar body to carry out this work.

- **Task 2** – Check that all LED lenses are firmly fitted and undamaged.

Rectification – If any of the lenses are not firmly fitted or damaged in any way then refit or replace as necessary.

- **Task 3** – Check that the Graphos bracket is in good condition and firmly attached to the sign.

If a Helios bracket is used then check there is no damage to the bracket and that it is firmly attached to the sign. Check the sacrificial mechanism isn't cracked or broken.

Rectification – Replace any brackets or the sacrificial mechanism, if damaged cracked or broken.

- **Task 4** – Inspect the antenna, ALS and Bluetooth module seals, are they damaged in any way?

Rectification – Replace seals, if damaged.

- **Task 5** – Check the ALS carefully, ensure it is clear of any obstruction. A symptom of an obscured light sensor is a dim sign in bright conditions. Ensure there is no bird guano on the sensor light pipe,
  Rectification – Remove any obstructions and clean, if necessary.

- **Task 6** – Check that the pole mounting is firm and there are no signs of subsidence. Check around the vicinity of the pole for any animal activity, i.e. rabbits, badgers etc. as these may have undermined the sign foundations.

Rectification – Any subsidence around the pole mounting is to be reported immediately to your Line Manager. The site should be made safe prior to departure and work carried out to correct the problem. Things to check for given the likely urban environment of these signs, would be the proximity of any damage caused by any burrowing animals e.g. rabbit holes or location of local drainage.

- **Task 7** – Inspect the mounting pole for defects and damage. Ensure there are no dents in column and check for paint integrity and corrosion.

Rectification 1 – Any minor defects and/or damage to the mounting pole is to be documented in the site log book, it should be documented in any PI sheet being completed. Then ensure your line manager is made aware.

Rectification 2 – Any serious or major defects and/or damage to the mounting pole is to be reported to your Line manager immediately. Work should be carried immediately to rectify the problem if this is not possible then the site is to be secured and made safe to pedestrians and motorists alike prior to departure. Repair or replacement work should be planned and carried out as soon as is possible after. The defect/damage and any rectification work carried out are to be documented in the site log book and PI sheet.

- **Task 8** – Inspect the sign fascia for defects and damage. Ensure there are no dents in column / pole / post, and check for paint integrity and corrosion.

Rectification 1 – Any minor defects and/or damage to the sign fascia is to be documented in the site log book, PI sheet and your line manager made aware.

Rectification 2 – Any serious or major defects and/or damage to the sign fascia is to be reported to your Line manager immediately. Work should be carried immediately to rectify the problem if this is not possible then the site is to be secured and made safe to pedestrians and motorists alike prior to departure. Repair or replacement work should be planned and carried out as soon as is possible after. The defect/damage and any rectification work carried out are to be documented in the site log book and PI sheet.

- **Task 9** – Check the door to the MDU, it should be firmly attached with no possibility of water ingress or damage and the lock un-tampered with.

Rectification – Replace the door or door seal if the level of damage or signs of water ingress warrants it.

MDU

- **Task 1** – Open the door to the MDU and check for any insect infestation or animal activity.

Rectification – Clear any dead insects. Any infestation or animal activity is to be documented in the site log book and PI sheet and should be monitored closely.

- **Task 2** – Check for any water ingress – a small amount of condensation is to be expected.

Rectification – Check door seal and replace if required.

- **Task 3** – Inspect the wiring and equipment within the MDU, to ensure it is in a sound condition.

Rectification – Re-wire, refit or replace any unsound wiring or equipment.

Sign interior

- **Task 1** – Open the door of the sign and visually inspect the contents. Check for any unusual odours – these may be symptomatic signs of damaged or aged components.
- **Task 2** – Check that the expected status LEDs are illuminated and no fault codes are in evidence on the LSCU 7-segment display. Code [00] on master, [01] for slave 1, [02] for slave 2, etc, should be displayed, if any other codes are displayed then refer to the maintenance section of this document.
- **Task 3** – Visually check all connections and ensure all are fully pushed home, haven't worked loose and that the connector latches are locked in place.
- **Task 4** – Check that the seals, around the sign fascia door, are intact and undamaged. Check there are no signs of water ingress.

Rectification - Replace the seals if damaged or if water ingress is visible within the sign.

- **Task 5** – Inspect the air filters, ensure they are clear and porous.
  Rectification - If particularly dirty or blocked replace them.
- **Task 6** – Check for any insect ingress. A small amount of dead insects within the sign is to be expected.
  Rectification - Clear any dead insects to be found loose in the bottom of the sign.
- **Task 7** – Check that the door hinges and fixings are not damaged and have free and easy movement.

Rectification - Replace any hinges or fixings, if damaged. If the hinges and fixings do not have free and easy movement then add a small amount of penetrating oil to them. **Note:** Ensure any surplus oil is wiped away, making sure that there are no oil marks left on the black surface of the sign fascia.

Sign cleaning

The preferential method for cleaning the sign is to jet wash the sign front and back to remove traffic film and any other deposits.

- Ensure all doors closed and fixings firm before commencing cleaning. Only perform this if the sign is dirty.
- Do not aim the jet at air filter vents or door seals for any great duration or the seal may be damaged and water will enter the sign.
- Stubborn deposits such as mud or bird guano may require manual intervention and cleaned with a wet cloth.
- The liquid used for jet washing may use a mild detergent solution.
- In hard water areas ensure the water used for cleaning is suitably softened - hard water containing calcium deposits will result in marking on the display surface this should be avoided.
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